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AUTHOR Dusick, Diane M.

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ABSTRACT

This study tested the importance of administrative support policies, faculty perception of that support, and motivational beliefs on community college faculty use of computers for instruction. The results support the conclusion that faculty perception of support, task self-concept, belief in the value of computers for instruction, and computer competence are separate constructs that are correlated. All of the motivational beliefs variables examined were strongly and positively correlated with each other and computer use for instruction. However, the important finding of this study is that task self-concept does not directly influence a teacher's choice to use computers. Rather, one's belief that computers are beneficial for both teacher and student, and one's level of competence mediate the effects of self-concept on use. Further, all of the motivational beliefs, as well as faculty perception of administrative support, mediate administrative efforts to influence faculty use of computers. To the extent that these findings are generalizable, there are clear implications for administrators: equipment must be readily available in classrooms, laboratories, and faculty offices; and efforts should be made to provide training and ongoing support that demonstrates the utility of computers in the classroom. This document concludes by stating that more research is needed to determine how faculty perceive computer technology and its role in the traditional pedagogy, and that future studies should explore these issues in the K-12 setting as well. Appended are available staff and technology, administrative support for computers in the classroom, task self concept and task value, computer competency, and computer use by faculty data. (Contains 139 references.) (NB)

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EFFECTS OF ADMINISTRATIVE SUPPORT POLICIES, COGNITIVE PROCESSES, AND MOTIVATIONAL BELIEFS ON FACULTY USES OF COMPUTER TECHNOLOGY: TESTING A MOTIVATIONAL MODEL

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ABSTRACT

EFFECTS OF ADMINISTRATIVE SUPPORT POLICIES, COGNITIVE PROCESSES, AND MOTIVATIONAL BELIEFS ON FACULTY USES OF COMPUTER TECHNOLOGY: TESTING A MOTIVATIONAL MODEL

This study tested the importance of administrative support policies, faculty perception of that support, and motivational beliefs (i.e., task self-concept, belief in the value of computers for instruction, and computer competence) on community college faculty use of computers for instruction. The results support the conclusion that faculty perception of support, task self-concept, belief in the value of computers for instruction, and computer competence are separate constructs that are correlated.

All of the motivational beliefs variables examined were strongly and positively correlated with each other and computer use for instruction. However, the important finding of this study is that task self-concept (i.e., confidence and anxiety) does not directly influence a teacher's choice to use computers. Rather, one's belief that computers are beneficial for both teacher and student, and one's level of competence mediate the effects of self-concept on use. Further, all of the motivational beliefs, as well as faculty perception of administrative support, mediate administrative efforts to influence faculty use of computers.

To the extent that these findings are generalizable, there are clear implications for administrators. In order to increase the use of computers by both teachers and students, equipment must be readily available in classrooms, laboratories, and faculty offices. However, although faculty were generally positive about the level of support provided by

their schools, the interaction between their perceptions and their value of computers as an instructional tool indicates that an effort should be made to provide training and ongoing support which demonstrates the utility of computers in the classroom.

More research is needed to determine how faculty perceive computer technology and its role in the traditional pedagogy. Future studies will need to explore the same issues raised by this study but for K-12 as well as the University setting. Future studies should also be conducted using an experimental design. Replication of this study should include direct observations and ratings of use between schools of varying levels to determine if actual use does vary significantly from school to school.

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DEDICATION

This dissertation is dedicated to the memory of Stephen J. Dusick (December 3, 1916 - November 3, 1994), who never had the opportunity to see it, and to Edith F. Dusick who always encouraged me.

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CHAPTER I

THE PROBLEM AND ITS UNDERLYING THEORETICAL FRAMEWORK

Introduction

The influence that Internet technology is having on commerce, industry, broadcasting, and education is astonishing (Perrone, Repenning, Spencer, & Ambach, 1996). Yet, while the ubiquity of computers in our society is without question, the growth of computer technology has brought educators to a crossroads in pedagogy. Van Dusen (1998) claims that to achieve the goals of making postsecondary education more accessible, affordable, and effective via technology, educators must change the way they use time and allocate resources, as well as examine the role of faculty, staff, and the mission of the institution itself. State legislatures around the nation are feeling pressured to provide educators with new technologies (Ruppert, 1998), while at the same time, employers are expecting graduates to be computer literate (Davis, 1997; Furst-Bowe, Boger, Franklin, McIntyre, Polansky, & Schlough, 1996).

Background of the Problem

This scrutiny from government, the public sector, the business community, and within educational institutions themselves, is forcing schools to seek to improve students' understanding and use of technology to facilitate their transition from student to employee (Thomas & Knezek, 1997). But this requires a fundamental change in education which can only occur after faculty have accepted technology as a teaching tool as vital as textbooks, pen, and paper (Norman & Spohrer, 1996). This transformation from the traditional classroom to the technological one is slow and arduous for educators (CAUSE Current Issues Committee, 1997). Although computers are readily accessible,

and their price has decreased even as their capabilities have increased exponentially since the introduction of the personal computer (Breithaupt, 1997; Marcinkiewicz, 1996), research indicates that teachers are more averse to using computers than other professionals (Hanushek, 1998; McKenzie & Clay, 1995; Paprzycki & Vidakovic, 1994).

But the world, and the educational community with it, is shifting paradigms; the teacher at the front of the room is no longer the focus of the students' attention (Branson, 1990). Learner-centered, performance-paced instruction puts the knowledge database and expert systems as the focus of both students' and teachers' attention. This paradigm shift requires an evolution in people's beliefs, which in turn impels altered behaviors (Porras & Robertson, 1992; Porras & Silvers, 1991). The influence of beliefs is powerful in the classroom; a teacher's educational and personal beliefs affect their choice whether to adopt and use technology for instruction (Honey & Moeller, 1990). Those personal beliefs are mediated by others. From a cultural perspective, the potency and permanence of shared beliefs are intensified (Schein, 1985). Clearly, a school culture which compels a strong belief in the worth of computer technology and a constructivist environment, including administrators' and teachers' pedagogical beliefs, influences classroom activities.

This penetrating reconstruction of education is focusing on modern methods of teaching and learning, and ways to better serve an increasingly diverse student population. Educators must change to meet the technological demands of the twenty-first century and the increasingly computer-literate student. The current constructivist trend in pedagogy, which is central to the relevance of computer technology, must be supported on an organizational level in order to become engrained in the school culture (Norman, &

Spohrer, 1996). Yet a 1994 survey of two hundred thirty institutions of higher education found that 80% of the responding institutions had no explicit expectations for faculty use of computer technology (AASCU, 1995). These same institutions also left faculty to assess their own technology competence level and needs.

Statement of the Problem

Knowing that computer technology provides a plethora of useful teaching tools, and implementing those tools successfully in the classroom are two separate issues. As Perrone et al. (1996) acknowledge, there is a wide variance in teachers' knowledge about technology and networks. Strudler (Winter, 1995-1996) found that in a follow-up study seven years after implementing technology plans and establishing technology coordinators, three elementary schools continued to face obstacles to the integration of computers in the classroom. Strudler's study illustrates the difficulty of effecting significant pedagogical changes with technology, including dealing with the continual need to upgrade technology, training teachers, and providing technical support.

According to Rogers (1995), an individual is more likely to adopt an innovation if that innovation is perceived as having (a) greater relative advantage than the current method, (b) is compatible with existing values and needs, (c) is not too complex to understand and use, (d) may be readily experimented with on a limited basis, and (e) the results are visible. Yet, Rogers continues, adoption of innovation is not merely an issue of individual adoption, but rather of the individual's communication network, and the sociological system within which it operates. This then raises the question, how are schools to motivate faculty to adopt technology in the classroom?

Tetreault (1997) recommends that educators promote technology as a "multi-dimensional set of interactive resources that in aggregate have the potential to positively affect student achievement" (p. 178). But there is no organizing framework integrating what we know about the motivation of faculty to use computers for instruction that will help guide schools in their adoption and implementation of computer technology into the existing pedagogy. However, if schools are to improve faculty and student use and understanding of computer technology, they must ultimately create a deep and lasting reform in the underlying pedagogy. In other words, although we do not have a clear blueprint for how schools can prevail in transforming faculty beliefs and behaviors in relation to computer technology, and, ultimately, their pedagogy, many educators are accepting the challenge, and we can learn from their efforts.

The Purpose of the Study

All educators are facing the age of technology and the need to prepare students to use that technology (Dusick, 1998-1999). California Community Colleges, like all educational institutions, face the mandate of preparing students for the technological job market of the twenty first century. The primary purpose of this study is to examine the relationship among the environmental, cognitive, and behavioral factors that are related to the use of computers for instruction by community college faculty. Further, the study will examine whether faculty perceptions mediate administration efforts to encourage the use of computer technology. Finally, the study will examine whether variables representing task self-concept, task value, and expectancy, influenced their choice.

This is an exploratory study, with a hypothesized motivational model. This study will test the proposed model and the relationship of the independent variables with each other and the dependent variable (computer use).

Research Questions

QUESTION 1: Is there a relationship between level of support for technology and the faculty's perception of administrative support for computer technology?

QUESTION 2: Is there a relationship between the faculty's perception of administrative support in each of the following factors: (a) availability of equipment and supplies, (b) morale building, (c) faculty training, and (d) technical support and the use of computers in the classroom by community college faculty?

QUESTION 3: Are there relationships among the cognitive processes (i.e., level of the faculty's perception of administrative support) and motivational beliefs (task-specific self-concept, task value, and expectancy)?

QUESTION 4: Is there a relationship between motivational beliefs (task-specific self-concept, task value, and expectancy) and computer use by community college faculty?

Significance of the Study

The educational system has been given a mandate: to turn out computer-literate graduates. Thomas and Knezek (1997) claim that those who graduate with no technology skills will see their standard of living, and possibly their ability to earn a living, plummet. Community colleges are proactively seeking ways to successfully prepare students for the technological future, as indicated by the profusion of new roles for educators, and models of a new constructivist pedagogy related in the research literature. But though the integration of computer technology into the classroom is in its third decade, many faculty

still are reluctant to abandon traditional methods of teaching. Teachers are using the same techniques as their predecessors have throughout most of this century (Perkins, 1992). However, there are innovators in the classroom. Dusick and Yildirim (1998) found that faculty could be divided into three distinct categories: high-end computer users, low-end computer users, and non-computer users. Many of the high- and low-end computer users were found to be self-motivated, in having sought their own training, and in having provided their own equipment. This study is concerned with establishing a hypothesis of how to effectively provide administrative support and motivation to those faculty who are reluctant to use, or who are adamantly opposed to using, technology.

One important reason for this study is that currently it is not clear what types of administrative support are most successful in encouraging in-service teachers to use computer technology. Over the past decade, researchers have made numerous observations on what factors influence instructor use of computers for instruction. Administrative support is clearly one of those factors. However, administrative support can take many forms. This study will help clarify whether there is a significant relationship between type of administrative support and increased faculty computer use. Administrative support is in many ways the foundation to systemic change. Without it, only the innovative faculty who are willing to experiment at their own cost, with their own equipment, will be teaching in the new paradigm.

Many of the research studies that examined the significance of administrative support were experimental designs supported by grants or using short-term interventions. While they clearly demonstrated the significant results of key factors, they do not represent how administrations are truly supporting computer technology over the long-

term. This study will examine how administrators are supporting teachers and their use of computer technology, and determine if there is a significant relationship among those variables.

In addition to administrative support, there are numerous cognitive and behavioral factors, which have been found to be significant in influencing faculty use of computers. However, no studies have yet examined the relationship of these variables to determine if there are mediator or moderator effects. For example, is self-concept (anxiety and confidence) mediated by competence and task value? This study will examine the relationship of these variables in a path analysis design.

The constructivist model of learning has influenced the use of computer technology in the classroom. This model stresses a student-centered curriculum and the social nature of learning (Norman & Spohrer, 1996). Computer-based training (CBT), distance education, and other modes of teaching with technology require faculty who are competent in computer use and who are able to provide a flexible learning environment that is ever-changing and based on the needs of the students. If government, the public sector, the business community, and school administrators expect faculty to move toward this model, then administrative support and staff development practices must endorse it.

In a survey of 324 CEO's of community colleges, 99% indicated their belief that the use of information technology in instruction will continue to increase, and 100% agreed that computer technology training for faculty will be an essential part of staff development (Millron & Leach, 1997). In the end, the importance of this study is that it will establish a link between type of administrative support and the integration of technology into the curriculum. It will determine whether it is more important for

administrators to concentrate on actual use of computers, or whether use should be addressed through other variables (e.g., competence, anxiety, task value).

This study will also determine if there is an intrinsic connection between administrative support for technology and the value faculty place in the use of technology for instruction. Further, it will be generalizable to other community colleges. Administrators may learn from the successes and failures of those who are attempting to make creative, systemic changes in the way their schools integrate technology into the classroom. Transforming the educational system is never easy, but examining the successes and failures of some schools will provide guidelines to others. Community college students will be the ultimate beneficiaries of these results.

Definition of Terms

Computer Technology - in relation to this study, computer technology is defined as the hardware and software used to produce, store, retrieve, and distribute analogic or digital representations of information that are designed to target specific learning objectives. It is not the design process in creating educational materials.

Administrative Support - actions taken by responsible administrators, which promote the use of computer technology by faculty and students. Administrative support in this study is measured by the perceptions of faculty, as well as the number of computer laboratories available for faculty and student use, technical and training staff on campus, and faculty and student access to technology. Administrative support in this study includes four specific areas:

1. Equipment and supplies: the administration recognizes the need to provide adequate equipment and supplies for faculty and students,
2. Technical support: the administration recognizes the need to provide a technical staff capable of equipment repair, and answering faculty questions on the operation and technical use of computers including troubleshooting, as well as the operation of specific software,
3. Morale building: the administration recognizes the need to encourage the adoption of technology in the classroom, and takes steps to address faculty and students needs and concerns, and
4. Training: the administration recognizes the need to provide on-going training, including stipends, release time, and training staff.

Task-Self-concept - the assessment of one's confidence in one's ability in a particular area, and is measured by two factors:

1. Confidence: a subscale of the Computer Attitude Scale (Gressard & Loyd, 1986), which measures the subject's level of self-assurance when using computers, and
2. Anxiety: a subscale of the Computer Attitude Scale (Gressard & Loyd, 1986), which measures the subject's level of apprehension when using or thinking about using computers.

Value of Computers - the assessment of one's value of the usefulness of computers for instruction, as measured by three factors:

1. Utility: the usefulness of computers in the classroom for achieving student success,
2. Interest: the personal preference for, or general enjoyment of computers in a variety of settings (including non-school related activities), and

3. Importance: the value of doing well with (and modeling) using computers so their students can succeed.

Computer Competency - learned skills occurring in numerous areas or 'domains' of computer applications (Dusick, 1998b). Those domains measured in this study include knowledge and level of ability in:

1. Word processing applications: programs, which work like a computerized typewriter, and allow you to make corrections and edits before saving or printing.
2. Spreadsheet applications: programs designed in a grid of rows and columns which create cells, in which you can put text, numbers, or formulas to create a worksheet,
3. Educational software: programs designed to present information, instruction, or testing to students.
4. Internet applications: programs which permit searching through the World Wide Web using tools such as an Internet Service Provider (ISP), hotlinks, gophers, search engines, and bookmarks, as well as the ability to communicate with remote users via text, audio and/or video, synchronously or asynchronously,
5. Multimedia applications: programs designed to create and/or present any combination of audio, video, and/or two- or three-dimensional graphics, and
6. Repair/peripherals: the ability to do basic maintenance on a computer, or solve minor software or hardware problems, including use equipment separate from the personal computer that can be integrated with a variety of software programs to enhance the capabilities of the computer (e.g., printers, scanners, etc.).

Methodology

This study employs a quantitative approach to research by: (a) conducting surveys using self-report questionnaires to collect data from a sample; (b) utilizing measures with a quantifiable coding to operationalize latent variables (Bogden & Biklen, 1992); and (c) using multivariate statistical procedures including path analysis to analyze the data collected and test the a priori model.

Assumptions

For this study, the following assumptions are made:

1. The participants will respond accurately to all measures,
2. The measures employed are reliable and valid indicators of the constructs to be studied,
3. The data will be accurately recorded and analyzed,
4. All relationships among selected variables are linear,
5. The community colleges which participate in the study are representative of community colleges which are using computer technology,
6. The purposes, processes, and elements of the framework studied have a degree of applicability and generalizability to schools and districts throughout the country, and
7. The research, data gathering, and findings and conclusions of the study represent "good research."
8. The goals of the teachers in the study include the desire to be a quality teacher, and that goal may or may not include the use of computer technology.

Delimitations

The study will confine itself to surveying the faculty and administration from seven California community colleges. The study will focus on the faculty perceptions of administrative support, faculty self-concept, faculty value of computers for education, computer competence level, and amount of use of computers by faculty in subject areas that do not require technology for instruction. Only full-time faculty will be included in the study.

Limitations

This study is limited to subjects who agree to participate voluntarily.

Validity of this study is limited to the reliability of the instruments used, and to the honesty of the subjects' responses to the instruments. As in many causal comparative studies, the constructs are based on self-report measures that may artificially inflate relations among factors. The validity of this data is controvertible in view of potential social desirability. Also, survey studies may be compromised by the comparability of results across different school settings.

Another limitation is that contextual factors may influence the results (e.g., school size; smaller schools are limited by smaller budgets, and therefore may be less able to provide equivalent support). Socioeconomic status of student populations are not considered in this study, and may be a contributing variable. These are only a few of the potentially confounding variables that may affect the outcomes of this study.

Organization of the Study

Chapter One of the study presents the introduction, the statement of the problem, the purpose of the study, the questions to be answered, the significance of the study, the definitions of terms, the assumptions, limitations, delimitations, and organization of the study.

Chapter Two is a review of recent literature.

Chapter Three presents the methodology used in the study, including a description and rationale of the sample, the data collection procedures, a description of instrument development, and the methods of analysis of the data.

Chapter Four presents the findings of the study.

Chapter Five summarizes the findings, draws conclusions, and makes recommendations. References and appendixes conclude the study.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Chapter two is a review of the literature. Main topics are (a) a dispute over media effectiveness, (b) computer technology and diffusion of innovations, (c) administrative support and faculty computer use, (d) a motivational model, (e) a review of the four key factors in administrative support: 1. training, 2. technical support, 3. morale building, 4. equipment and supplies, (f) motivational beliefs: task self-concept (anxiety and confidence), value of computers (utility, importance, and interest), expectancy (computer competence), and (g) achievement behavior (computer use).

A Dispute over Media Effectiveness

Ever since Clark (1983) raised the questions of the effectiveness of media and the controvertible results of empirical scrutiny, researchers and educators have disputed whether the use of educational technology has resulted in effective learning outcomes. Not all researchers agree that educational technology is an effective replacement for traditional methods. In a call for further research, Jones and Paolucci (1998) reviewed over 800 journal articles searching for direct empirical evidence that supports the claims of published authors. Their conclusion was that researchers have not yet clearly demonstrated quantifiable learning outcomes that can be achieved and sustained through technology adoption. And in a scathing rebuke at schools, Oppenheimer (1997) remarks that:

> There is no good evidence that most uses of computers significantly improve teaching and learning, yet school districts are cutting programs -- music, art, physical education -- that enrich children's lives to make room for this dubious nostrum . . . (p. 45)

Oppenheimer supports his case by stating that, among other arguments: (a) there is no solid research evidence supporting the case for computers in the classroom, (b) the high-tech quality of computers encourages students to spend more time thinking about presentation than content, (c) the use of computers 'slows a person's ability to think', and (d) students concentrate on the manipulation of the software rather than the critical thinking behind the exercise they are performing.

Clark (1983, 1994) claims that media will never influence learning. His argument is that any advantage is vulnerable to rival hypotheses: (a) the effects of content differences between instructional methods - with and without media - were not controlled, and therefore the medium was not necessarily the cause of any significant effect, (b) the novelty effect caused temporary improvements in learning (i.e., a learning method that is new will automatically be more exciting, and therefore temporarily elicit significant increases in learning), and (c) it is the method of instruction, not the media, that fosters learning.

Since the appearance of the initial article in 1983, Clark's claims have been hotly debated in the literature (e.g., Bagui, 1998; Kozma, 1991). Kozma argues that media stand out through their cognitively relevant characteristics such as symbol systems and processing capabilities, thereby enabling students to process information more effectively, and understand it more fully. Bagui also found that, contrary to Clark's belief that media do not influence learning, because multimedia allows guided discovery,

student involvement in learning is increased, understanding is greater, and the intrinsic features of the computer (e.g., immediate feedback, animation, and individualization) are more likely to motivate students to learn. In an interesting twist to McLuhan's (McLuhan & Fiore, 1967) observation that "the medium is the message," Kearsley, Lynch, and Wizer (1995) found that on-line activities, specifically, classes taught via distance education, had higher student satisfaction, the same or higher grade-point average, and often more discussion among students and instructors.

In a discussion of research on the World Wide Web and its use in the classroom, Windschitl (1998) asserts that there is not enough research examining critical questions such as how the Internet is helping students, or how technology is changing pedagogical practices. Although his goal is to encourage the research community to critically examine the medium's influence, he stops short of disparaging its usefulness. While Windschitl agrees with Clark's (1983) suggestion that the computer is 'just another medium', he acknowledges that the web appears to be reshaping the world as it creates virtual communities. For Windschitl, it appears that the question still remains to be answered: do media influence learning? And he is willing to beg the question: if it *does*, how?

Pedagogy and Educational Technology

Jonassen (1996) calls computers "Mindtools" for engaging and enhancing thinking, implying that their integration in education must go beyond basic data collection and analysis (Walters, 1997). Otherwise, computer-based instruction will fail to lead the student to constructed learning (Brown & Lowther, 1999). In his attack on computers-as-teaching-tools, Oppenheimer (1997) presents an example of a student using

a simulation game, where the student manipulates the system, but is unconcerned with the reason for the outcome. He claims this is evidence that simulations discourage the student from asking questions. Rather, one can argue, the fault is not with the tool, but the way in which it was used. If a student were given a chemistry set and spent hours combining chemicals to produce unusual reactions, but was then unable to then explain the reactions, one would not blame the chemistry set, but the lack of concurrent instruction. Researchers who found the technology used appropriately in a constructivist environment did not find the same negative results as Oppenheimer (Baker, Hale, & Gifford, 1997; Okolo, Barth, & Rieth, 1993; Massy & Zemsky, 1995; McGrath, 1998).

Examining the integration of pedagogy and computer technology must go beyond individual instructional programs. The purpose of technology is to be a tool, like pencil, paper, and books, and, just as a student must learn to read and write to properly utilize these tools, students must develop the appropriate skills to effectively use computer technology. In a review of information literacy and competency outcomes for students, the American Association of Higher Education (Gratch-Lindauer, 1998) presented these technology skills as critical for student learning. Students can: (a) use technological tools for accessing information, (b) access and effectively use campus information systems, information networks, and the Internet to locate information appropriate to the need, (c) use interlibrary loan, document delivery, electronic transmission, or other means to obtain material not available locally, (d) communicate using a variety of information technologies, (e) produce and communicate information in effective and appropriate formats, and (f) students are aware of the structure and dissemination channels of the global information environment.

Learning Outcomes vs. Long Term Consequences

Clark (1983) has made the claim that equal learning outcomes are possible with or without technology, as long as the underlying pedagogy is sound. Jones and Paolucci (1998) found no empirical evidence in a wide range of research to support the notion of effective learning outcomes with the use of media. Windshitl questions the effectiveness of the World Wide Web. So, is the massive investment in technology in our nation's schools a waste of money?

While the debate has raged over whether technology has been significantly *more* effective than traditional methods, Oppenheimer (1997) has claimed that technology has actually decreased learning outcomes. But, is it the technology that produced negative results, or the method in which it was used? Clark's (1983) argument that it is not the technology but the pedagogy embedded within it that enhances learning. In each of Oppenheimer's examples, it was not the technology, but its misuse - e.g., lack of guidance provided to students, or the teacher's lack of self-efficacy regarding technology - that lead to negative outcomes.

And therein lies the decisive factor: technology alone does no harm to the learning process, and there are benefits, which are not directly measured by specific learning outcomes. Woodrow (1998) perhaps summed it up best when she said:

> The question whether computer technology should be in the classroom is about as sensible as questioning the wisdom of Gutenberg's invention: if it is accepted that all humans, rather than a self-selected few, must have access to all knowledge, then the technology essential for access must also be understood and taught - and it is not taught by classes describing the complexities of machinery: it is taught by the direct application of the computers to the learning requirements of the subject. (p. 5-6)

Our job as educators is more than just to educate. It is to prepare students to be capable, productive citizens when they graduate. As far back as the early eighties, researchers were predicting that many jobs in the 21st century will require computer knowledge, and unskilled members of the workforce will be at a disadvantage (Fary, 1984). And according to California Partnership (1997), by the year 2000, close 70% of all jobs will require computer use. Davis (1997) found that current employers have a high expectation of computer literacy in college graduates. Desired skills range from word processing, spreadsheet and database knowledge, to programming and Internet publication. The net result is that future employees will either be able to work with technology, or be replaced by it.

Educational Equity

An interesting question which arises when discussing technology is the distribution of funds to those who need it most. Even if learning outcomes are identical with or without technology, if computers are not placed in schools for all students, only those students whose families provide them access will develop the necessary skills to compete in a technological world.

Disadvantaged students should receive increased educational funding to lessen the chasm between their academic achievement level and that of the typical U.S. student (Kohl & Witty, 1996). Yet examination of available technology exposes gaps between schools, which serve middle class, and minority populations (Heaviside, Riggins, & Farris, 1997). At-risk students are not afforded the same opportunities as socially and economically well-off students (Crosby, 1993). For example, Heaviside, Riggins, and Farris report that classrooms in schools with 71 percent or more

low SES students were about half as likely to have Internet access as schools with lower levels of poverty. Unquestionably, if we are to avoid a next generation of "haves" and "have-nots," we must provide technology in schools to maintain some level of equity for disadvantaged students.

Summary/Conclusions

There is an on-going dispute over the effectiveness of media in the classroom. However, the definition of 'effectiveness' is called into question: should educators be concerned only with immediate outcomes, or are there broader issues to consider?

Researchers should never concede the quest for alpha: empirical evidence is a significant part of the scientific method, and a critical source of valuable information to guide policy. However, the definition of outcomes must also be carefully examined before condemning a method as not a significant improvement or not cost effective. Therefore, in deference to Jones and Paulucci, who suggest that researchers use formal experimental methodologies to demonstrate quantifiable learning outcomes, the consequences of that research alone could be substantially detrimental to the state of education if the bigger picture is not considered.

We must establish a level of research that identifies long-term outcomes, and tests the results of the teaching/learning process involving technology on the success of our graduates. This is not a study that can be done in one semester, one year, or even two. But the foundations of the research must be laid now, before too many administrators, taxpayers, and politicians see the results of studies, which demonstrate "no significant difference" between students who learn with a teacher, blackboard, and chalk, and

students who had the benefits of multimedia technology. If not, we may do irreparable harm to our educational system before we realize it.

Computer technology and Diffusion of Innovations

"Diffusion is the process by which an innovation is communicated through certain channels over time among members of a social system" (Rogers, 1995). Every diffusion study contains each of these four main elements: an innovation, communication channels, time, and a social system. Rogers' model was created with a global perspective, incorporating the diffusion of new ideas and products from such diverse spheres as the field of agriculture and research in third world nations.

Diffusion theory is an attempt to quantify and qualify any type of change in the structure and function of any given social system. It is, therefore, relevant to the study of the adoption and implementation of technology in the classroom.

The Innovation

An innovation is a process, organizational, or social in nature (Maguire, Kazlauskas, & Weir, 1994). It can be an idea, practice, or object that is considered new by an individual or group (Rogers, 1995). 'New' is not necessarily defined as something previously unknown, but something an individual has not yet developed a favorable (or unfavorable) attitude toward, or something the individual has simply not yet made a decision about to adopt or reject. Rogers defines the characteristics of a given innovation which might explain the different rate of adoption by early or late adopters as: (a) its relative advantage, (b) compatibility with the adopters' existing values, past experiences, and needs, (c) complexity or difficulty to understand and use, (d) trialability, or how

easily it can be experimented with on a limited basis, and (e) observability, or visibility in the community.

Some type of computer technology (e.g., film strips, films, television, transparencies) has been available in classrooms for much of the latter half of the twentieth century (Knirk & Kazlauskas, 1997), and, as computer technology and presentation media (e.g., projectors, monitors) improve, more and more people are discovering its utility. But whether or not an individual chooses to use computers depends on their perception of its advantages.

Cummings (1996) claims that technology enhances attention and concentration by intensifying the delivery of information, ideas, and experiences, and through its ability to tailor content for different learning styles. However, disadvantages will discourage many faculty from adopting computer technology. Kozma (1977) found that faculty may resist computer technology if they found it depersonalizes education, is of poor quality, equipment is unavailable or obsolete, or they fear the impact on their role as professor.

According to Oliver (1994), while beginning teachers were more likely to accept computers if there had been a technology component in their educational program, the considerable pressures they faced in their early days in the classroom were also a deterrent. On the other hand, Wayman (1996) discovered a new world of staff development from her first experience with the World Wide Web. She encountered teachers from all over the country who willingly shared successful classroom strategies. As she became familiar with constructivism, she began to change her classroom from a teacher-directed to student-centered.

Obviously, compatibility with existing values, past experiences, and needs is an area requiring a significant amount of attention from technology professionals and change agents, and must be supported on an organizational level, if more teachers are to accept technology in their classrooms.

Communication Channels

"Information plays a large role in the process of innovation . . ." (Porter, 1990, p. 48). Communication is the process by which participants share information, and diffusion is a particular type of communication concerned with an innovation (Rogers, 1995). According to Maguire, Kazlauskas, and Weir (1994), communicated messages contain data, theories, background, ideas, opinions and more. They may be delivered via person-to-person exchanges, face to face, through communications devices, at conferences and meetings, or a variety of media such as journals, books, databases, pictures, etc. Regardless of how the information is spread, innovation cannot become part of an institution if its impact is not communicated.

But the communication of innovations cannot be examined without considering the individual (Maguire, Kazlauskas, & Weir, 1994). Rogers (1995) states that communication proceeds through the various categories of adopters in different ways, and at different rates. Innovators freely seek out new information and experiences, and early adopters follow soon after. Early and late majority however, wait, seeking information from peers. This information can come from a variety of areas. Organizational leaders should be proactive in order to orchestrate change and produce desirable outcomes (Beckhard & Pritchard, 1992). Across a range of studies, evidence indicates that staff development programs are integral to the integration of computers into

the curriculum (e.g., Parker, 1996). And Vockell, Janich, and Sweeney (1994) found that teachers were encouraged by communication through school-sponsored workshops, mentoring from colleagues, and finally, support from administrative change agents.

Time

Diffusion of computer technology within a school setting is a complex phenomenon that must be systemic in order to be successful. According to Pogrow (1996), in order for change to be effective it must be attempted incrementally. Lack of knowledge of the duration of the change process, including the complexity of the problems and the nature of the resistance of some members of the population can lead to the failure of reform efforts (Fullan & Miles, 1992).

Hall and Hord (1987) stated that change is a process rather than an event. However, that process does not 'just happen', but must be facilitated. These facilitators are change agents: individuals who can influence members of a population to adopt an innovation (Rogers, 1995). In relation to the school setting and computer technology, change can be implemented through institution-wide commitment, administrative support, and staff development (Hoffman, 1996; Mittelstet, 1992). Change agents can be administrators, technology support personnel, or interested faculty.

Schools are comprised of faculty, staff, and administrators in various stages of willingness to embrace change (Hall & Hord, 1987), and successful adoption of innovations is based in part on the characteristics of that population. Rogers (1995) breaks adopters down into five categories: (a) innovators, who are often rash or daring, (b) early adopters, who serve as a role model for other members of the social system, and are central to communicating the utility of an innovation, (c) early majority, who may

deliberate for some time before adopting a new idea, (d) late majority, who are skeptical, and require peer pressure to adopt an innovation, and (e) laggards, who are suspicious of innovations and change agents, and must be certain that the innovation will not fail before adopting.

Rogers (1995) breaks the innovation-decision process into five main steps: (a) knowledge, when the individual learns of the innovation, (b) persuasion, when the individual forms an opinion (favorable or unfavorable), (c) decision, when the individual engages in activities that lead to adoption or rejection, (d) implementation, when the innovation is put to use, and (e) confirmation, when the individual seeks reinforcement of the decision. Schein (1985) claims that innovators' beliefs become part of the organization's culture, and manifest themselves in the physical and social environments. Through the life of the innovation, those cultural artifacts reach higher levels of consciousness in the individuals. In other words, Schein continues, as the basic assumptions regarding an innovation change over time, cultural restructuring occurs.

The Social System

"Institutionalization is the point at which an innovative practice, having been implemented, loses its 'special project' status and becomes part of a routinized behavior of the institutional system" (Berman & McLaughlin, 1974, p. 16). Community College administrators planning the diffusion of computer technology need to consider the perceptions of the potential adopters in relation to the proposed innovation's characteristics (i.e., advantage to the teaching/learning process, compatibility with the teacher's existing value, teaching style, etc., its complexity level, including the support

system the school is willing to provide, and its visibility within the school - who is already using technology?) if the proposed change is to be successfully implemented.

Rogers (1995) calls attention to an obstacle to implementation of innovations within organizations:

> In an organizational setting, a number of individuals are usually involved in the innovation-decision process, and the implementers are often a different set of people from the decision makers. Also, the organizational structure that gives stability and continuity to an organization may be a resistant force to implementation of an innovation. (p. 173)

Research indicates that teachers are more likely to be positive and enthusiastic about innovations when they participate in the development of specific policies regarding the proposed changes (Ham, 1997). This participation by all stakeholders creates a support system, which is fundamental to the success of diffusion of innovations (Fullan & Miles, 1992; Schofield, 1995). Teachers can use their social network to communicate positive information regarding technology, and provide support for one another. It is through this social network that an innovation is supported and its success expedited (Fullan & Stiegelbauer, 1991).

Change agents can facilitate the acceptance of the innovation by providing the physical and support environment (Farquhar & Surry, 1994). Schofield (1995) maintains there are multiple factors in providing a supportive environment including: (a) adequate training, available when the teachers can take advantage of it, and which is compatible with the available hardware and software, (b) support staff, including a technology coordinator, as well as staff to install, maintain, and support the technology, and (c) adequate infrastructure. Without the appropriate support structure, teachers (other than

innovators and early adopters) will be unwilling attempt and continue to use technology in the classroom.

Summary

Diffusion theory is clearly relevant to the adoption of computer technology by teachers. Administrators, faculty, and support staff must be aware of the issues that affect adoption decisions, and knowledge of diffusion theory may mitigate costly mistakes.

The successful change agent within an educational setting will understand and utilize all the factors, which promote the implementation and use of technology within the context of the entire social system. The successful change agent understands the advantages of transitioning to technological classroom environments, yet is concerned about all of the factors, which affect potential adopters of a new innovation. The change agent must be aware of the compatibility (or lack thereof) with the adopters' existing values, past experiences, and needs; address issues of complexity and the difficulty of understanding and using technology in the classroom for the first time; and provide staff development opportunities, technical support, and training which in turn provide a 'safe haven' to experiment with technology without embarrassment. And finally, the successful change agent will be sure that computer technology is visible throughout the school system so that those who have not yet chosen to adopt the new innovations will at least be aware of others' successes. In the process of implementing all of these concepts, the successful change agent will involve all stakeholders in the development of a plan for the diffusion of the innovation in incremental steps, while providing adequate physical and environmental support.

Administrative Support and Faculty Computer Use

Statistics as recent as 1995 reported by Communications Development, Inc. reveal discouraging facts about American school teachers: only sixteen percent of teachers use the Internet or on-line services and less than 15% of technology budgets are devoted to training. A 1997 study (Dusick, 1998a) found that 26% of respondents never used the Internet and only 13% used it often.

But not all teachers or school systems suffer from indifference toward technology. For example, in a comparison of two schools, Vockell, Janich, and Sweeney (1994) found that the commitment of resources led to substantial improvements in the instructional use of computers in one school, while the other school lagged behind. Interestingly, there were no significant differences in the teachers' perceptions of what contributes to effective computer use. Teachers at both schools rated self-training, school-sponsored workshops, and encouragement and help from colleagues very highly. But the school with stronger administrative support, which provided key resources, had a significantly higher rate of computer use for instruction. Those resources included hiring a full-time instructional computing coordinator, using a start-up grant to train a core of teachers with stipends for training, seeking funding from public and private sources, and developing a feeling of pride and professionalism in their teachers. Obviously, a difference can be made.

There are a number of factors which have been identified as contributing to the inadequate use of computers among educators: (a) lack of access to equipment, (b) lack of funding, (c) lack of understanding about what resources technology offers, (d) lack of training and support, (e) technical and logistical problems, and (f) issues such as

copyright and intellectual property rights, (OTA 1995), as well as (g) unmotivated faculty and (h) lack of appreciation of faculty efforts (Hoffman, 1996). Loveless (1996) claims organizational constraints are critical to technology use. Hanusheck (1998) speculates whether the lack of incentives (i.e., improved student performance is seldom rewarded), and the worry that computers may lessen the demand for teachers, are underlying causes of minimal computer use among faculty. The challenge is to ascertain effective reform efforts, despite the number of significant constructs.

Proposed solutions to these problems include institution-wide commitment, administrative support, and staff development in the area of information technology (Hoffman, 1996; Mittelstet, 1992). However, while the literature is clear in the need for strong administrative support (Hoffman, 1996; Hutinger, 1995; Mittelstet, 1992; Schwandt, 1996), researchers do not always identify or agree on types of support, and differences in faculty and administration perceptions of that support have not been explored. Tetreault (1997) for example, categorized technology resource measures into staffing, hardware, and infrastructure domains, and found that these categories capture nearly all relevant computer technology issues. Staffing includes the ability of school personnel to effectively use technology. Hardware refers to computers and all peripheral devices (e.g., printers, CD-ROM players) that extend the computer's functionality. Infrastructure includes network connectivity. Tetreault subdivides these into administrative and instructional resources.

For purposes of this study, the salient issues identified as problematic are divided into four distinct areas: training (addressing lack of understanding about what resources technology offers, lack of training), technical support (addressing technical and logistical

problems, lack of support), morale building (addressing issues such as lack of motivation and lack of appreciation of faculty efforts), and equipment and supplies (addressing lack of access to equipment, lack of funding).

Summary

There are numerous factors, which contribute to faculty use of computers for instruction, including lack of equipment, training, and technical support, as well as motivational factors such as lack of incentives. However, there are solutions, which can be instituted by administrators. These efforts fall into four categories: training, technical support, morale building, and equipment.

Motivational Model

Before examining what administrative support variables influence the teacher's choice to use computer technology, it is helpful to review a motivational model within which to fit the administrative support structure and faculty cognitive processes, which influence their decisions.

Pintrich and Schunk (1996) describe a social cognitive expectancy-value model, based on an Eccles (1983) study, which can be applied to faculty motivation (see Figure 1). The social world, or educational environment, could be interpreted to include the school's support structure for computer technology in the four areas: training, morale building, technical support, and equipment. Further, it can include such social interactions as seeing other faculty being successful with computers in the classroom, hearing other faculty discussing computers, seeing family members, friends, or acquaintances using technology. Past performances and events may include non-

instructional uses of computers, then choosing to apply those skills to education. Teachers may even be influenced by their students' knowledge or interest in computers.

The cognitive processes are interpreted as faculty perceptions of those social world factors. These perceptions, interpretations, and attributions of the social world may lead to specific convictions such as whether the teacher believes computers are effective teaching tools, whether they enhance or detract from teacher-student or student-student interactions, whether computers may replace some teachers, or whether they believe their school administration is not supportive of faculty who try new or innovative techniques. A teacher may even conclude that, because they are effective without computers, that they do not need them to teach. These are exogenous (educational environment) and mediating (cognitive processes) variables of motivational beliefs: faculty goals, self-concept/perception of task difficulty, interpretations of the value of computers and expectancy for success.

Within the context of this model, faculty goals are considered to be their desire to be successful in the classroom. Self-concept and perception of task difficulty are considered to be confidence in their ability to use computers, and levels of confidence and anxiety. Task value has been defined by Eccles and Wigfield (1985) as interest in, the importance of, and the utility of the task. For purposes of this study, task value is the teacher's value of computers as an instructional tool.

Finally, motivational beliefs are based in part on expectancy for success. Faculty are more likely to expect success in computer use if they are competent with the technology. These factors then, should, in turn lead to achievement behavior: in the faculty model, classroom use of computers.

The administrative support construct can be viewed as both an exogenous variable in the Dusick Model Of Computer Use for Instruction as the educational environment in which faculty members work, and as a mediating variable, as the faculty perceptions of administrative support (see Figure 2). While it is clear from the motivational model that achievement behavior (use of computers) cannot occur without positive motivational beliefs, those beliefs may be influenced by the educational environment and cognitive processes, which result from that environment.

Although the Eccles (1983) model was developed to examine the motivations of adolescents, Gagne, Yekovich, and Yekovich (1993) contend that processes of human learning are thought to be universal, and therefore, they are applicable to young learners or adults.

Summary

This study proposes a model of achievement motivation based on a social cognitive expectancy-value model. This model proposes a single exogenous variable, educational environment, which is hypothesized to directly affect faculty perception of the environment. This independent variable then affects task self-concept (i.e., confidence and anxiety), which in turn is mediated by the faculty member's value of computers and their level of computer competence. These two variables directly affect achievement behavior: computer use in and outside the classroom.

Four Key Factors In Administrative Support

1. Training

There are numerous staff development activities designed to facilitate the acquisition of new concepts and skills. Kazlauskas and Maxwell (1992) found that in

order for faculty development programs to be successful, they must aid teachers' ability to be experts, develop specific instructional skills, and be grounded in the individual's discipline. Teachers are exposed to computers and learn technology skills in numerous ways: self-study, conferences and workshops, courses, in-service training, coaching/mentoring from other instructors, or on-site consultants (Hadley & Sheingold, cited in Hoffman, 1997). In order to encourage the adoption of IT, schools need to provide a safe method for teachers to explore the technology without facing the threat of embarrassment in the classroom due to failure (Schofield, 1995).

The implementation of a technology plan must acknowledge the variety of teaching and technology experiences, attitudes, and capabilities of teachers. It is the teacher's capacity to fashion technology-based learning that will determine whether or not the students' needs are met. Therefore, before implementing staff development training, the technological skills of classroom teachers need to be assessed (Fulton, 1998).

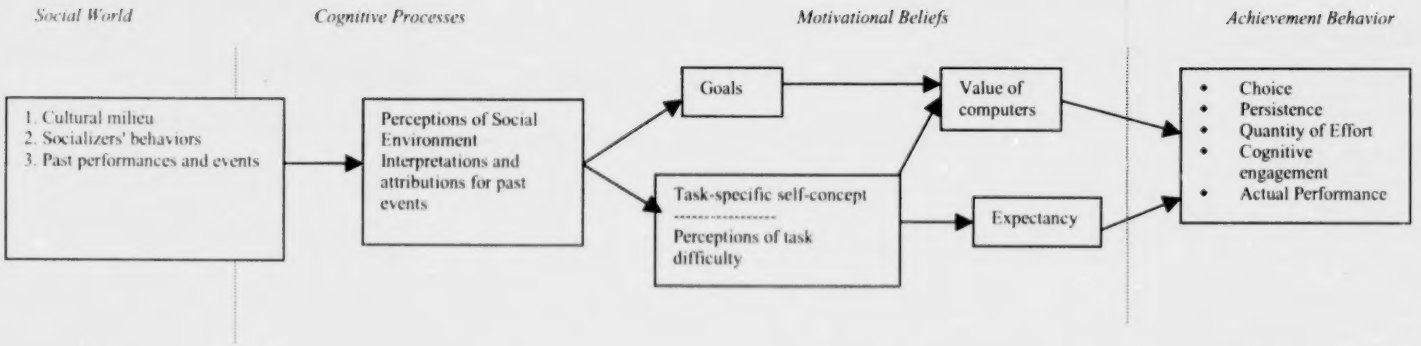


Figure 1. Pintrich and Schunk modification of the Eccles Model Of Achievement Motivation (cited in Pintrich & Schunk 1996)

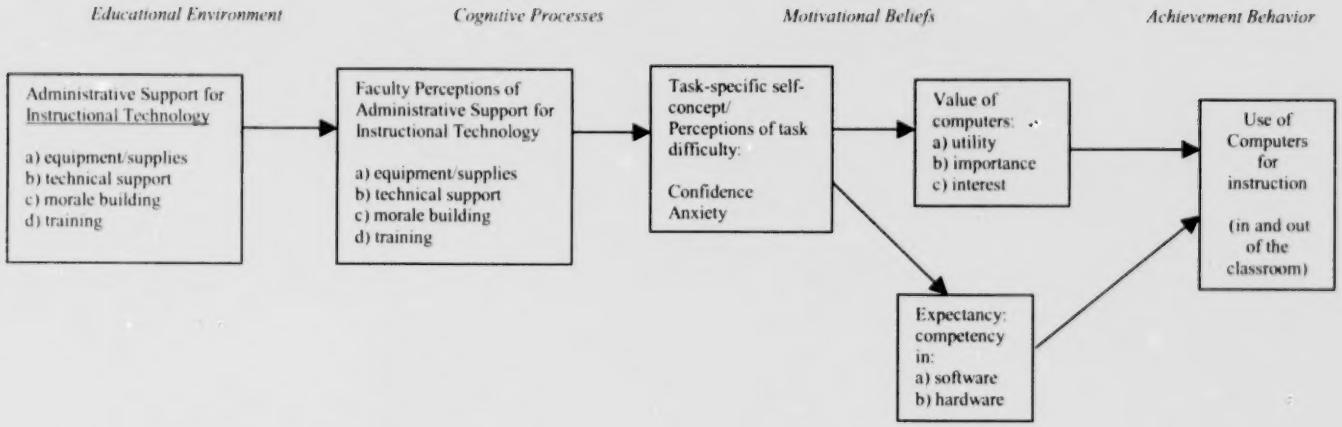


Figure 2.

Operational model of administrative support of Computer technology, faculty perceptions, beliefs, and classroom use of technology: based on Pintrich and Schunk modification of the Eccles Model Of Achievement Motivation; Dusick Model Of Computer Use For Instruction, 1999

Bandura (1989) noted that if performance outcomes are perceived as successful, efficacy and motivation increase; if outcomes are perceived as failures, efficacy and motivation decrease. Therefore, training must be based on: (a) the current abilities of classroom teachers, (b) the needs of the students, and (c) an understanding by trainers that outcomes in training sessions must be perceived as successful by teachers.

Dwyer, Ringstaff, and Sandholtz (1991) defined five steps which transformed "chalk and talk" classrooms into technology-intensive environments: (a) entry (technology is available), (b) adoption (the instructor incorporates the technology into established instructional patterns), (c) adaptation (increased teacher and student productivity), (d) appropriation (experimentation), and (e) invention (implementation of an integrated curriculum). Each of these steps is accompanied by appropriate support (staff development): (a) entry (advance planning time available, and team planning), (b) adoption (technical support and training), (c) adaptation (flexible scheduling, alternative pedagogies, more training), (d) appropriation (peer observation and discussion, reexamination of mission, encouragement and support), and (e) invention (collaboration, mentoring, contact with more innovators).

In an effort to determine what was the main obstacle to faculty obtaining formal training with instructional computing, both computer users and non-users indicated lack of time as the most important factor (Dusick & Yildirim, 1998). Abbey (1997) found that faculty were concerned about the amount of time needed for training, preparation for classes, professional activities such as conferences, and the time involved in reducing student lab access time for multiple sessions. Further, she found the Technology

Coordinator was concerned with how much time was needed to create appropriate learning materials.

According to Hoffman (1997) teachers rarely have the dozens or even hundreds of hours it takes to become comfortable with digital technology. Hoffman claims that teachers need an estimated five to six years of staff development to become proficient. These are not encouraging facts to teachers who are already overburdened with large class sizes and little assistance, and is a clear indication that administrative support and more supportive staff development policies are critical.

Clearly, schools must have a technology plan, which incorporates faculty training from beginner through advanced levels. Training must develop specific instructional skills, which enhance the classroom teaching and learning process. And finally, administrators can address the time component by providing technical support and a training coordinator, release time for development of materials and training, and stipends for time spent outside of the normal work day.

2. Technical Support

According to the U. S. Department of Education (1996), providing adequate technical support to maintain technology use is a formidable task for schools. The Department of Education asserts that at least five kinds of technical assistance are necessary: (a) helping teachers plan for technology use and acquisition, (b) providing training in new hardware and software use, (c) providing demonstrations and advice on how to incorporate the technology into instruction, (d) providing help on-demand when software problems or hardware problems arise, and (e) performing low-level maintenance on the system.

Meltzer and Sherman (1997) claim that effective technology plans must include a technology coordinator with prior classroom experience. If teachers are unsuccessful in the classroom, they are unlikely to try it again. An on-site coordinator who provides both technical and pedagogical support has the potential to change a negative experience into a positive one. Tetreault (1997) suggests that if technology can make a difference, there are prerequisite conditions to ensure that difference. For example, schools must have trained staff capable of using computers for the delivery of instruction.

In reviewing the main obstacles to faculty integration of technology, Cummings (1995) identified the lack of qualified support personnel and outdated institutionalized traditions (i.e., environments that are resistant to change, especially in regard to electronic, or student-directed modes of education) as primary disincentives. And Hoffman (1997) found that maintenance is possibly one of the most overlooked factors in successful technology integration. Faculty who are often faced with broken equipment, slow repairs, and unqualified technicians will be unlikely to attempt to use the equipment again.

But technical support does exist. In a survey conducted online and through e-mail, Lee and Johnson (Autumn/Winter, 1998) found that 72% of respondents had technical assistance in their college, with 34% reporting having resources available directly through their department or division. However, respondents were already connected to the Internet, or members of an educational technology listserv, and were therefore likely to already be computer technology users. Consequently, the question becomes, what can educational institutions do to maximize the successful integration of computers into their classrooms? Administrators and technology committees must adopt

an active technology plan which incorporates the five types of technical support recommended by the U.S. Department of Education, provide extensive support in learning skills for faculty and staff, and develop new teaching and learning philosophies which utilize the distinctive capabilities of instructional technology.

3. Morale Building

Ely (1995) suggests that by inviting teachers to participate in the planning process, they will 'buy-in' to technology applications. He goes on to state that the underlying pedagogy must change. Teachers can no longer expect to teach students all the answers, but rather how to pose the right questions, find the information, and apply it to the problem. This change in beliefs goes beyond using technology for presentation of lecture material. It requires the instructors to use the technology as a tool for teaching and learning, in effect, revising their pedagogy.

In the Apple Classrooms of Tomorrow (ACOT) experiment, elementary school teachers were funded through Apple Corporation to develop curriculum using technology and institute it in their classrooms. Once they were no longer funded and were unsupported in their classrooms, these teachers had little time to continue learning or developing. They also found little support for their attempts to share their experiences and knowledge. Their colleagues were unwilling to give up time for the training they were willing to provide (Sandholtz, Ringstaff, & Dwyer, 1997). Teachers clearly lacked the administrative support needed to continue these projects and incorporate them into the school culture.

Before a teacher is willing to commit time to learning new skills with technology, he or she must be willing to accept the personal risks. Abbey (1997) acknowledged that

the integration of technology begins with positive acceptance by 'early adopters', but raises the question at the end, 'what do we do about faculty who do not want to use technology?' Geoghegan (1995), a higher education consultant at IBM, found that (a) faculty aversion to risk, (b) little tolerance for change, and (c) a lack of compelling reasons to try technology, were responsible for the minimal use of computers in the classroom. George, Sleeth, and Pearce (1996) identified different groups of faculty: (a) those unwilling to take risks, (b) those with low knowledge of technology but enthusiastic and willing to learn more, (c) those who would be considered 'dabblers' and (d) experts. Each of these categories of educators is at a different 'risk level'. Experts and 'dabblers' are willing to take risks and experiment with IT. Those unwilling or unknowledgeable, however, are more difficult for technology trainers to reach. These are often the faculty who have little tolerance for change, and have discovered no compelling reason to try teaching with technology. It is unlikely that these faculty will attempt to use computers without administrative support.

But perhaps the most telling comments were from faculty who never used the word 'risk'. According to Young (1997), a Canadian University ended a 55-day faculty strike in which new technology was a major issue. David Clipsham, chairman of the faculty union, stated that the union took a pre-emptive move, fearing the administration was moving too fast into technology, which no one in the university understood. York University faculty worried that multimedia (a) reduced face-to-face contact, (b) discouraged critical thinking, (c) had bugs or glitches that wasted valuable teaching time, and (d) perhaps most telling, may be used by administrators to one day 'eliminate direct labor'. Clearly these represent significant risks that many faculty would be unwilling to

take. It also indicates that administrators cannot simply create policies, which demand the integration of technology without addressing larger issues of pedagogy, staffing, and union concerns.

4. Equipment and Supplies

Personal computers have developed into powerful tools since their introduction into the mass market. PCs today serve as a mass communication medium capable of playing or producing multimedia, or 'surfing' the Internet and World Wide Web environments. Other developments in technology (e.g., Web-TV, interactive cable television, and fiber optic communications) allow the rapid exchange of data. Relating these advances to learning, Rogers (1996) proclaimed that Americans had just "crossed the point of critical mass for instructional use of information technology in higher education" (p. 29), and that one result was new financial and infrastructure demands on universities. One outcome of this ubiquity is that each year more students have access to electronic mail, the World Wide Web, and other forms of computer technology (Green, 1997). Clearly, teachers, too, must have access.

Bork (1997), in exploring the future of computers and learning, noted the strong push for technology in education. While he acknowledged that this means more computers for classrooms, he expounded on the need for "infrastructure," meaning networks, connections to networks, and computers to run the networks. Bork further noted that there is little worthwhile software available, and that most of the material on the World Wide Web is of "low-quality." Yet in a survey of community college presidents, 97% acknowledged that the cost of purchasing and supporting information technology is a key issue (Miliron & Leach, 1997).

Students growing up in the 80s and 90s have been exposed to more technology than any other generation, having televisions, computers, and other technology in their homes and schools. They recognize technology's importance and usefulness, and many have used computers as tools for study, or games, which stimulate their interest. Minnesota-at-Crookston, a University on the verge of closure due to low enrollments, implemented an innovative program in a desperate move. Every student received a laptop, which could be plugged into any desk in any classroom. The results were astonishing: enrollment increased and the school prospered (Withrow, 1997).

But purchasing equipment and supplies is not the only relevant issue. According the Office of Technology Assessment (1995), schools often place computers in laboratories rather than individual classrooms, modems are at a central computer, and most classrooms lack telephone access, so even with computers in the room, they are unable to connect to other sources. The result is less use of available technology by both faculty and students. Bender and Bender (1996) believe that careful consideration must be given to the physical location of the computers (in the classroom versus a laboratory), as well as the frequency and scheduling of student use.

Summary

In summary, there are numerous difficulties which faculty face in their attempt to use of computer technology. The risks faculty are unwilling to take can be interpreted as the potential loss of control of their classroom (they will no longer be lecturing, but facilitating cooperative learning), the loss of control of the content, and the loss of personal contact with their students. But perhaps most important is the fear of the loss of their own jobs. Even these issues cannot be faced unless the teachers have equipment

with which to begin. These are significant consequences and concerns, which must be addressed by administrators.

Motivational Beliefs

Task Self-Concept

Eccles and Wigfield (1985) found that low self-concept of ability leads to expectations of failure, and that efficacy perceptions influence choice and persistence on task. Further, self-concept has motivational properties that will affect subsequent achievement (Byrne, 1996). This study defines task self-concept by measures of anxiety and confidence. Eccles and Wigfield found anxiety has a debilitating effect on task self-concept, and Buhendwa (1996) interpreted computer confidence as a measure of self-efficacy. Nash and Moroz (1997), in an examination of the factor structures of the Computer Attitude Scale (CAS), found that the confidence and anxiety subscales measure along the same continuum. Therefore, for purposes of this study, Task Self-concept is considered to be a measure of a faculty member's anxiety toward and confidence with computer technology.

Anxiety. Computer anxiety is associated with computer interaction and is disproportionate to the actual threat presented by the computer (Anderson, 1996). The two most common terms found in the research are "computer anxiety" and "computer-phobia," and both terms are occasionally used synonymously. For purposes of this review, "computer anxiety" is considered to be a generic term that encompasses all levels of anxiety. The questions arise regarding why does an individual have anxiety about computer interaction, how can the anxiety be identified, and how can the anxiety be dealt with?

Avoidance of computer interaction is the primary indicator of computer anxiety, and additional indicators include an individual's prior computing experiences, attitudes towards computers, perceptions of self-efficacy, and expectations of success (McInerney, McInerney, & Sinclair, 1994). The etiology of computer anxiety has been reviewed from several theoretical stances. It may be a result of low self-efficacy, low expectations of outcome, or lack of reinforcement (Meier, 1985). It may also be examined from a clinical standpoint, ranking the anxiety from mild to severe (Rosen, Sears & Weil, 1987). There appear to be increasing levels of anxiety from minor levels of discomfort to highly techno-phobic anxiety.

A significant research study by Rosen, Sears, and Weil (1993) identified three levels of computer or techno-phobias. Computer-phobics can be divided into three basic categories: first, the anxious computer-phobic who exhibits sweaty palms, heart palpitations, headaches, or other physiological symptoms, second, the cognitive computer-phobic who appears calm, but has inner self-directed messages such as Al'm going to hit the wrong button and break it!," and third, an uncomfortable user who is slightly anxious, but basically lacks knowledge and experience. Subjects were assigned to a treatment which matched their level of computer anxiety: thought stopping and covert assertion for the most anxious, systematic desensitization for the cognitive computer-phobic, and providing information and support for the uncomfortable user. Subjects who were most computer-phobic were assigned to both thought-stopping treatments and support groups. Subjects demonstrated decreased computer anxiety, improved computer cognition, and enhanced computer attitudes within five weeks, regardless of their initial level of phobia. At all levels, computer-anxiety was effectively

dealt with by raising the user's self-efficacy, or confidence in his or her ability to complete the task.

Confidence: Student Efficacy and Technology. A summa-cum laude student who is technophobic or computer illiterate is potentially unemployable, if the prediction of researchers regarding technology skills is true (Fary, 1984; Davis, 1997). It is the role of educators to give students the knowledge they need to succeed, and that knowledge goes beyond rote learning and test performance. It includes the ability to search for information with all available media, to utilize technological tools to accomplish a variety of tasks, and to display their concepts and ideas in three-dimensional form using multimedia (Gratch-Lindauer, 1998). To do this, students must be self-efficacious in the use of computer technology.

Self-efficacy theory is based on the supposition that psychological assessments afford a means of forming and/or strengthening expectations that one can achieve an outcome (Bandura, 1989). Personal efficacy expectations regarding the use of computers are based on four sources of information: performance accomplishments, vicarious experiences, verbal persuasion, and emotional arousal (anxiety producing situations) (Olivier & Shapiro, 1993).

First, performance accomplishments will raise self-efficacy to the point where it is taken for granted, and occasional failure then will mean much less to the student. Second, students who fear technology may benefit from observing others. Vicarious reinforcement will occur if students observe peers and the instructor successfully performing tasks on the computer. Third, instructors can use verbal persuasion to encourage students, though Olivier and Shapiro (1993) point out that verbal

encouragement alone is not enough to develop and maintain self-efficacy. Finally, avoiding anxiety-producing situations, such as putting a student in a situation where he or she cannot be successful, will maintain self-efficacy, if it (self-efficacy) is developed using the other three types of interventions.

In other words, in order to build a student's self-efficacy in the use of computers so he or she will be capable of utilizing them successfully beyond school, we must give them the tools in school. Computers in the classroom will provide additional benefits to students beyond immediate "learning effectiveness": first, students will develop self-efficacy in the use of technology - critical to future employment; second, they will be able to observe others using technology successfully and gain a deeper understanding of its importance and usefulness; third, anxious or computer-phobic students will have the opportunity to face their anxiety in a safe environment, and through the instructor's verbal persuasion and emotional support may be able to avoid worse anxiety producing situations in the workplace.

Confidence: Teacher Efficacy and Technology. Teacher efficacy in relation to computer use in the classroom is equally important. In general, a teacher's sense of efficacy has been shown to be a powerful predictor of student outcomes (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). In the Apple Classrooms of Tomorrow experiment, Sandholtz, Ringstaff, and Dwyer (1997) found that teachers who were using technology for the first time were preoccupied with their own adequacy: they were overly concerned with their ability to maintain control over the classroom and the students. Teachers spent more time reacting to problems with the technology rather than anticipating and avoiding them. This led to their doubting their abilities. Those who

overcame their fears and concerns progressed from the 'entry' stage (deciding to use IT, and attempting it) to the 'adoption' stage, where teachers focused more on teaching and learning. In effect, their self-efficacy increased.

Technology-reluctant teachers can be empowered through technology training (Slough & McGrew-Zoubi, 1996). In an attempt to increase technology self-efficacy in preservice teachers, Slough and McGrew-Zoubi taught preservice teachers to publish on the World Wide Web without HTML programming experience. Their positive results included teachers creating more professional work and seeing themselves as more likely to use technology in their classrooms.

Task Value (Value of Computers)

Eccles (1983) stated that achievement motivation is based on an individual's perception of his or her expectancies, values, and behavior. With computer technology, initially teachers are preoccupied with their own knowledge and abilities with the new medium and how it will affect their established classroom practices. However, as teachers become familiar with the technology, the emphasis moves to potential uses of the computer to promote learning (Wells & Anderson, 1995). For purposes of this study, values are identified as utility, interest, and importance.

Utility. In order for a teacher to adopt a new tool for instruction, he or she must accept it as a valuable tool, recognize its importance in his or her own teaching style, and be interested in adopting it. Research has demonstrated that, through the use of multimedia, or the pedagogy embedded within it, technology has the potential to improve instruction. For example, Baker, Hale, and Gifford (1997) support the belief that in comparison to the traditional classroom, well-designed computer-mediated instruction

improves student scores and attitudes toward learning, as well as decreasing learning time. Okolo, Barth, and Rieth (1993) claim that computer technology effectively improves academic achievement, motivation, and time-on-task, provided that positive outcomes have been demonstrated by objective measures. And Massy and Zemsky (1995) noted that information technology allows for repeated access to large amounts of material at low cost.

Clearly, it is beneficial for teachers to help students develop computer competencies. In an examination of the interactions between teachers and students in different classroom settings, Swan and Mitrani (1993) found evidence suggesting that the use of computers is changing the structure of teaching and learning; specifically, there are many more individual interactions between teachers and students in computerized classrooms than there were in traditional classrooms. In talking with teachers at the forefront of computer use in instruction, McGrath (1998) found that in classrooms with computers, students were more motivated, showed more persistence in solving problems, and demonstrated improved oral and written communication. There is little doubt that instructional technology will be increasingly used in education; the pressing need is to encourage faculty to adopt technology as a tool, which enhances student interaction and learning.

Students are not the only beneficiaries of classroom technology. Armstrong (1996) reviewed advantages for the instructor such as (a) the ease of adding or updating lecture material, (b) consistent delivery of information from class to class, (c) enduring technical quality over time, (d) and presentations which can be designed to match the exact needs of the students.

But to derive these benefits from computer technology, computers must be available in classrooms, teachers must become comfortable with the technology, and review their curriculum to determine how to best integrate the technology into their lesson plans (McGrath, 1998). Administrators, too, must consider critical issues key to the success of students. These issues include the use of instructional media as well as the course content. The Education Commission of the United States (1995) states that good pedagogical practice demands accommodation to diverse backgrounds and learning styles, and instructional technology has been shown to facilitate these diverse needs (Menlove & Hammond, 1998).

Importance. Eccles and Wigfield define attainment value (or importance) as the value of doing well on a task (Eccles & Wigfield, 1995, cited in Pintrich & Schunk, 1996). Computer literate teachers who use instructional technology to its full potential, and recognize the need to prepare their students for the twenty first century job market are the teachers who would most value "doing well" with technology.

Researchers have identified specific benefits of instructional technology to both teachers and students. In a meta-analysis of the literature, Khalili and Shashaani (1994) found that computer instruction was more beneficial if the instruction with technology lasted more than three weeks, and that different types of computer applications had different effects on students' learning and achievement. But most importantly, their study revealed that if teachers had more experience with computers, as well as a more positive attitude, their students learning improved.

In examining reasons for increased learning through the use of multimedia, Bagui (1998) found that multimedia makes use of information processing theory. Dual coding,

according to information processing theory, allows humans to input information through sense organs into short-term memory, where it is processed and stored in long-term memory. Bagui believes multimedia facilitate the learning process through dual coding: using more than one "code" such as text, voice, visuals, and imagery to present information. Bagui further speculates that dual coding reduces the cognitive load in a person's working memory by allowing one to treat multiple elements of information as a single element. This processing of information becomes important when instructions or procedures exceed working-memory capacity.

Eccles and Wigfield (1985) go on to further define importance as an individual's ability to confirm or disconfirm aspects of his or her self-schema. Clearly, by doing well at the task of using computers, teachers may enhance not only their students' experience, but their own self-satisfaction. For example, English teachers at the University of Michigan found that using electronic media enhanced pedagogical goals, extended the teaching strategies they were already using, and improved students' constructive comments in peer papers (Alexander, Crowley, Lundin, Mudry, Palmer, & Rabkin, 1997). These factors all add to the importance of using IT to its fullest (i.e., doing well on a task, in this case, teaching with technology).

Interest. Interest can be defined as or the personal preference for, or general enjoyment of computers in a variety of settings, including non-school related activities. While the literature often emphasizes the positive aspects of technology, it rarely distinguishes between the motivations and interests of faculty who use computers for instruction and those who do not, nor for those who are or are not computer-phobic. However, there are clues to the factors, which lead to interest in technology.

Although a number of reasons account for the minimal use of computers by educators, attitudes are clearly influential. Attitudes have been defined as an evaluative disposition based upon cognitions, affective reactions, behavior intentions, and past behaviors, and that disposition is capable of influencing future cognitions, affective responses, intentions, and behaviors (Zimbardo & Leippe, 1991). Woodrow (1991) believes attitudes not only influence whether one accepts computers, but also future behaviors such as using the computer as a professional tool, or introducing computer applications into the classroom.

In a journal maintained by one instructor while working in a faculty mentor program to gain more technology experience, the instructor commented, "My limited infusion of technology was not related to 'techno-phobia', but rather, to lack of understanding of what the computer can do and how technology could transform my college-level course" (Beisser, Kurth, & Reinhart 1997, p. 323). The motivational issues of early adopters and non-anxious computer users are clearly very different from those who are reluctant, uninterested, or unwilling to try technology.

Expectancy

Eccles (1983) found that an individual's expectancy for success plays a significant role in achievement behavior, and is directly influenced by self-concept of ability and the individual's estimate of task difficulty. However, in 1995, Eccles and Wigfield concluded that there is little evidence to justify distinguishing among students' ratings of their ability, current levels of performance, and expectations regarding their future levels of performance. This convergence of self-concept and expectancy constructs though, was based on questions such as, "How well do you think you will do on your next math

test?" In contrast, in a pilot study of the self-concept and competency instruments for this study, a principal components analysis showed the latent variables to be measuring two distinct factors, when competency questions included specific skill ratings such as, "Can you use formulas and advanced editing functions in spreadsheets?" Expectancy then, for purposes of this study, is measured by an individual's perception or self-report of competency.

Computer Competency in Education. In an issue directly related to faculty use of computers, research indicates that there is a significant correlation between level of computer competency and attitude (Yildirim, 1997), and between competency and level of use (Dusick & Yildirim, 1998). However, there is little consensus in the literature as to what constitutes computer competency. Beigel (1996) identifies some computer competencies for educators as: (a) the ability to evaluate and match appropriate software to a learner's skills and abilities, (b) helping students use computers as a personal productivity tool, (c) assessing individual needs, and (d) integrating technology into multiple environments. By contrast, a project in the College of Education at Eastern Illinois University focuses on the practical needs of faculty including (a) word processing, (b) statistical analysis, (c) database manipulation, (d) electronic mail, (e) file transfers, (f) file management, and (g) operating systems (Barger & Armel, 1992. Teacher education programs vary in their approach to helping pre-service teachers develop computer competency (Walters, 1992).

Computer literacy (an earlier term for computer competency in the literature) has been defined as "an understanding of computer characteristics, capabilities, and applications, as well as an ability to implement this knowledge in the skillful, productive

use of computer applications suitable to individual roles in society" (Simonson, Mauere, Montag-Toradi, & Whitaker, 1987, p. 233). In a study to evaluate the computer competency needs of students, the University of Wisconsin surveyed students, administrators, alumni, and employers. The data revealed a need for competency in the following areas: (a) use MS-DOS commands and the Windows interface, (b) manage files on a hard disk, (c) learn to use a program with the documentation provided; (d) generate business letters and research reports, (e) create a spreadsheet that includes formulas, (f) create, sort, and query a database, (g) create charts, graphs , and flow charts, and (h) send and retrieve electronic mail (Furst-Bowe, Boger, Franklin, McIntyre, Polansky, & Schlough, 1996). In addition to these software skills, Dusick (1998b) identified four areas of hardware/firmware knowledge as potentially important for computer users: (a) operating systems, (b) repair and peripherals, which includes troubleshooting basic problems and the ability to use a scanner or printer, (c) networking, or the ability to set up and use an Intranet, and (d) programming. The underlying theme in each study of competency is the need for practical skills in a variety of applications.

According to the American Association of State Colleges and Universities (1995), 22% of state colleges and universities require computer literacy of all graduates. In a discussion of the impact of technology on pedagogy and academic freedom, Skeele and Daly (1997) stated that desired student outcomes are cognate with expected faculty outcomes.

Current research stresses the need for computer literacy across the curriculum. Woodrow (1998) is concerned about the access to knowledge: technology provides access to all, provided they have the skills needed. Utah State University, in a model

program, views computer literacy as a college skill, rather than a course requirement, and to support that skill, has developed a set of seven modules: (a) an introduction to computer laboratories and electronic mail, (b), computer basics, which includes computer capabilities, hardware, and software, (c) operating system basics, (d) the ethics of access and use, (e) information resources, (f) document preparation, and (g) data visualization and spreadsheets (Cooley & Zhang, 1998). Further, in a move that foreshadows a critical need, Utah State University noted that ethical concerns such as copyright infringement are a necessary element of computer competency.

Information on teacher competency and computer use has been studied at all levels of education. In a meta-analysis of the literature, Khalili and Shashaani (1994) found computers at all grade levels - elementary, middle and high school, and college - all using a variety of applications (drill and practice, tutorial, simulation, problem solving, other) and implementations (replacement for or supplement to instruction). While the specific educational software varied from grade to grade and discipline to discipline, the applications and competencies are consistent throughout all levels.

Summary

The Dusick Model of Achievement Motivation hypothesizes three motivational beliefs: task self-concept, value of computers, and expectancy, or competency. Task self-concept is the assessment of one's confidence in his or her ability in a particular area, and is measured by two factors: 1. confidence, which measures the subject's level of self-assurance when using computers, and 2. anxiety, which measures a subject's level of apprehension when using or thinking about using computers.

Value of computers is the assessment of one's value of the usefulness of computers for instruction, and is measured by three factors: 1. utility, or the perceived usefulness of computers in the classroom for achieving student success, 2. interest, or the personal preference for, or general enjoyment of computers in a variety of settings, including non-school related activities, and 3. importance, defined as the value of doing well with (and modeling) using computers so students can succeed.

Computer competence includes a variety of learned skills in numerous areas or 'domains', including word processing, spreadsheet applications, educational software, Internet applications, multimedia applications, and the ability to do basic maintenance including solving minor software or hardware problems, or utilize peripherals such as printers and scanners.

Achievement Behavior

Computer Use

In 1986, Becker found that on average, less than 6 teachers per school used computers regularly. By 1989, McCoy and Haggard reported that while 75% of teacher respondents used computers, they were primarily used for drill and practice, tutoring, and a general introduction to the computer. Only 14% used computers for record keeping.

By contrast, ten years later, in a study examining the relationship between competency and level of use, Dusick (1998a) found that all teachers in the study indicated that they use computers in the classroom, with 75% reporting using computers for administrative tasks. However, within any given use-category (e.g., for presentations, testing, research), at least 51% reported that they did not use computers in that manner. The least-used category was web publishing, with 85% of the users reporting that they

never used web publishing in class, and only 2% using it daily. Forty five percent of the users reported using e-mail or communications, with 21% of those reporting they used it daily in class. Desktop publishing was also used significantly, with 49% reporting they use it in class, with 10% using it daily.

In the same study, more teachers reported using computers outside of the classroom than in the classroom. Only 9% reported that they did not use computers to create tests or handouts, 22% reported they never gave homework assignments that required a computer, and only 25% reported they never used computers for administrative tasks. The least-used category was again web publishing, with 84% of the users reporting that they never used web publishing in class. Thirty eight percent reported that they used e-mail or other telecommunications daily, with only 30% reporting they never use e-mail. The second most frequent daily use of computers was for administrative tasks, at 22%.

Dusick (1998a) found that a majority of teachers have adopted computer technology for some portion of their in-class activities and/or out-of-class preparation and administration. However, more than 50% of the teachers were not yet prepared to use multimedia presentations or other advanced programs in the classroom. Nevertheless, the study found that teachers who are competent in the use of discipline-specific educational software, and who feel confident in their ability to handle simple repair techniques such as solving basic hardware or software problems (e.g., the computer freezes) and can attach peripherals such as a digital camera, are more likely to use technology in the classroom. Competence in these same areas, as well as with multimedia and Internet use were strong indicators that a faculty member will use computers to produce materials or

use the Internet as a resource when outside the classroom. Surprisingly, word processing was only indicative of whether a teacher will use computers for administrative tasks or general uses, but was not correlated with in-class use.

Summary

Many researchers have come to believe that administrative support variables, as well as personal belief systems, including value of computers and expectancy, are important constructs that assist administrators and technology leaders with the successful implementation of instructional technology in the classroom to the benefit of teaching and learning. This belief rests on the assumptions that motivational models incorporate what is now known about changing and adapting teacher behavior patterns, and can serve as the foundation for pedagogical reform, and that needed reform must be extensively supported with multiple and coherent changes throughout the institution.

This study utilizes the Eccles motivational model as the pattern of behavioral change. The model starts with the educational world, is mediated by the individual's cognitive processes, which in turn influence the individual's motivational beliefs (i.e., value of computers and expectancy). These in turn affect the individual's behavior.

Summary/Conclusions

Clearly, though there is a dispute over media effectiveness, there are reasons that media can and should be used in the classroom. While opponents claim that media do not increase learning, proponents have found that use of media in instruction will help prepare students for a technological job market, promote equity in education, and develop self-efficacy in students. However, in order for students to utilize technology in the classroom, it must be available, and teachers must be willing to use it.

Diffusion theory suggests that there are four main elements which impact the acceptance of an innovation: the innovation itself, the communication channels which disperse information regarding the innovation, the time needed to test it, and a social system within which the innovation can function. Each of these elements impact whether or not instructional technology will become part of the culture at any school or school district. School culture, though not defined by the administration, is influenced by it. Administrators can affect the faculty's rate of adoption of IT in four ways: (a) providing equipment and supplies; (b) providing adequate technical support; (c) providing training; and (d) building morale (e.g., through release time, compensation for technology development).

In order for administrators to determine how to decrease the time it takes for faculty to adopt computer technology for instruction, it is important to understand the relationship of motivational factors to achievement behavior. To accomplish this, a motivational model of student achievement behavior is adapted for this study. This model hypothesizes that the educational environment is an exogenous variable, which influences faculty cognitive processes. In turn, the cognitive processes (i.e., perception of administrative support for instructional technology) mediate the affect of the educational environment on task self-concept, which is defined as levels of anxiety and confidence. In turn, value of computers (utility, interest, and importance) and expectancy (competence) are hypothesized to mediate the affects of task self-concept on achievement behavior (faculty use of computers for instruction). These two variables are then hypothesized to have a direct affect on achievement behavior.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this study is to determine whether there are significant relationships among administrative support for computer technology, faculty cognitive processes (perception of administrative support), motivational beliefs (task self-concept, value of computers, and competency), and faculty use of computers for instruction. The study examines whether administrative support, and perception of that support, significantly impact the subsequent use of computers in the classroom by community college faculty. Further, the study examines whether there is a mediational relationship between motivational factors (confidence, anxiety, utility, interest, importance, and expectancy), and faculty perceptions of administrative support in their affect on behavior.

Research Questions

As a precursor to formulating the study questions, the conceptual framework within the literature was examined. The Office of Technology Assessment (1995) illustrated 8 variables that impact on the effective use of technology in the classroom (see figure 3). This illustration, while informative, does not show the relationship between the variables. Dusick (1998-1999) found numerous social cognitive factors related in the literature that are significant predictors of technology use. However, no models have been proposed which examine the moderating and mediating relationships among various predictor variables and the criterion variable. Therefore, a theoretical model based on the Pintrich and Schunk (1996) modification of the Eccles Model Of Student Motivation is

hypothesized in this study, and relationships among selected variables are proposed (see Figure 2).

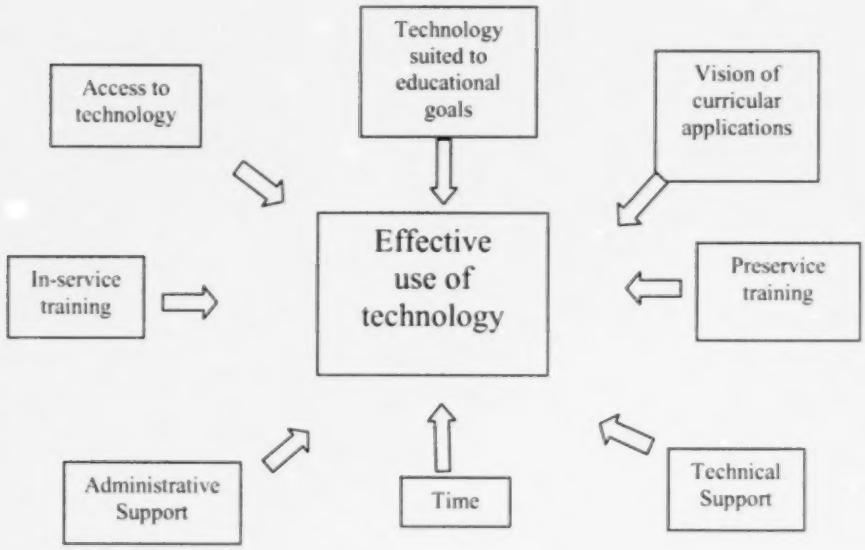


Figure 3. Eight Variables, Which Impact On The Effective Use Of Technology In The Classroom (OTA, 1995)

Motivational Model

The administration's support for computer technology is interpreted as part of the 'social world', or 'educational environment'. This support is manifested through available equipment, technical support, and training on campus.

The cognitive processes are the faculty perceptions and interpretations of those educational environment factors. These are exogenous (educational environment) and mediating (cognitive processes) variables of motivational beliefs such as self-concept and perception of task difficulty, and interpretations of value of computers and expectancy.

Finally, motivational beliefs are based on expectancy for success and value of computers. Faculty are more likely to expect success in computer use if they are computer literate, see the value in terms of usefulness, and importance, and are interested in the technology. These factors then, should, in turn lead to achievement behavior: classroom use of computers. See Figure 2.

This model generates the following research questions:

QUESTION 1: Is there a relationship between level of support for technology and the faculty's perception of administrative support for computer technology?

QUESTION 2: Is there a relationship between the faculty's perception of administrative support in each of the following factors: (a) availability of equipment and supplies, (b) morale building, (c) faculty training, and (d) technical support and the use of computers in the classroom by community college faculty?

QUESTION 3: Are there relationships among the cognitive processes (i.e., level of the faculty's perception of administrative support) and motivational beliefs (task-specific self-concept, value of computers, and expectancy)?

QUESTION 4: Is there a relationship between motivational beliefs (task-specific self-concept, value of computers, and expectancy) and computer use by community college faculty?

The research questions generated the following hypotheses:

Hypothesis 1: Faculty perception of administrative support will be significantly lower at schools with low actual support than at schools with high actual level of support.

Hypothesis 2: Faculty perception of administrative support is significantly and positively related to the use of computers in the classroom by community college faculty.

Hypothesis 3: Faculty perception of administrative support is significantly and positively related to task-specific self-concept.

Hypothesis 4: Task specific self-concept is significantly and positively related to value of computers and expectancy.

Hypothesis 5: Value of computers and expectancy are significantly and positively related to computer use in the classroom.

Methodology

Research Population

Forty-four southern California Community Colleges were invited to participate in the study. Eleven agreed to participate. Seven colleges were selected based on the following criteria: (a) at least one urban and one rural school were included, (b) small, medium, and large schools, based on enrollment were included, (c) at least one school with a self-reported high level of administrative support and one school with a self-reported low level of administrative support (based on a Spring, 1997 survey) were included.

All departments within participating schools which did not include computer-related disciplines were invited to participate. Only schools where full time faculty in the Science and Humanities divisions agreed to participate were included in the study. This study uses multistage cluster sampling (Babbie, 1997), in which specific community colleges were selected, and then faculty 'clusters' within the schools were sampled. To maximize the generalizability of the sample, schools with different demographics (i.e., rural/urban, large/small) were selected, and teachers from different departments and divisions were included. Part-time faculty were not included in the study, because in a pilot study, part-time faculty indicated little knowledge of the administration's actions, and would likely skew the results of the study.

In order to insure a significant return, a college administrator was contacted to act as liaison between the researcher and departments or divisions. Surveys were distributed during a department or division meeting when a majority of the faculty were present. As

an incentive to return the surveys, copies of demonstration versions of Toolbook I and II (courtesy of Asymetrix Learning Systems, Inc.) or Hyperstudio (courtesy of Roger Wagner Publishing, Inc.) software on CD-ROM were distributed to respondents.

Research Approach

This study employs a quantitative, causal-comparative approach to research by: (a) conducting surveys using self-report questionnaires to collect data from a sample; (b) utilizing measures with a quantifiable coding to operationalize latent variables (Bogden & Biklen, 1992); and (c) using multivariate statistical procedures including path analysis to analyze the data collected and test the a priori model.

Isaac and Michael (1995) define causal-comparative research as research that investigates possible cause-and-effect relationships by examining data for plausible causal factors. However, causal-comparative research does not employ random assignment or controlled conditions, as in experimental design. Because this study employs surveys administered in the field to intact groups (at faculty meetings) with the intent of suggesting plausible causal factors, it is a non-experimental design.

Although a correlational study cannot be used to determine cause, it may be used for causal inference using techniques such as path analysis (Cook & Campbell, 1979). Path analysis was designed to study direct and indirect effects of variables hypothesized as causes of variables considered to be effects and to "shed light on the tenability of the causal models a researcher formulates based on knowledge and theoretical considerations" (Pedhazur, 1997, p769), therefore, the relationship of the independent and dependent variables will be assessed with path analysis.

Design

The study employs a causal-comparative survey design. Key administrators, as well as members of the technical staff (e.g., computer technicians, technology trainers) at each institution with knowledge of administrative support of computer technology will be surveyed to determine the specific level of administrative support for computer technology. Faculty members in each participating department of each institution will be surveyed during a Department or Division meeting. Faculty not present at the department meeting will be randomly sampled to maintain the internal validity of the sample.

Instrumentation

The researcher developed a 69-item questionnaire with five subsections. Faculty completed the questionnaire during faculty meetings held in January, February, and March 1999. The measures for the variables are described in detail as follows, and are summarized in Table 3.

A separate questionnaire, AVAILABLE STAFF AND TECHNOLOGY, was prepared for the administrator responsible for technology (Appendix A). The purpose of this questionnaire was to determine the level of actual support for technology provided by the school. Questions included the number of open computer laboratories, the number of computers in each room, and the availability of training and technical staff.

Administrative Support

The survey form ADMINISTRATIVE SUPPORT FOR COMPUTERS IN THE CLASSROOM (Appendix B) was used to measure the level of administrative support provided by the Community College as answered by the faculty to determine their perception of administrative support. The questionnaire is composed of 17 questions

soliciting subjects' levels of agreement with statements about the levels of administrative support for computer technology at their school. A 4-point Likert-type scale was used for each question, with item response ranging from 1 (strongly disagree) to 4 (strongly agree). The questions were designed to reflect those domains related to perception of administrative financial and moral support for technology in equipment, training, technical support, and morale building.

Scale Development: Administrative Support. Principal components analysis was conducted to develop scale scores reflecting individuals' perceptions of the various domains of administrative support tapped by the set of questions. First, an initial pilot test was performed using a survey of all California community college technology administrators. A second pilot test of the administrative support instrument as well as the task-self-concept and value of computers instruments was performed using all the teachers and administrators at a Los Angeles area Catholic High School, and a third pilot test using a 50% random sample of faculty from one California Community College.

Item scores were subjected to a principal components analysis using an oblique rotation. The third pilot test, following revision of the instrument, resulted in four factors with eigenvalues greater than 1.0 accounting for 74.2% of the variance in the set of 17 items. The items grouped into four factors, each composed of conceptually similar items representing technical support (7 items), training (4 items), providing equipment (3 items), and morale building (3 items). The following assumptions were made: (a) the data represents a bivariate normal distribution for each pair of variables, and (b) the variables are determined by common factors (the factors estimated by the model) and unique factors (which do not overlap between observed variables).

The third pilot test of the instrument revealed that its scores were reliable (Table 1).

Table 1

Reliabilities for Administrative Support

Instrument	Cronbach's alpha
Administrative Support (17 items)	.93
Technical Support (7 items)	.92
Equipment (3 items)	.69
Training (4 items)	.89
Morale Building (3 items)	.82

Task Self-Concept

A survey form (VALUE OF COMPUTERS and TASK SELF-CONCEPT) asked faculty to weigh confidence and anxiety constructs. They were asked to rate each statement (e.g., Working with a computer would make me very nervous) 1 - strongly disagree, 2 - disagree, 3 - agree, or 4 - strongly agree (Appendix C).

Scale Development: Task Self-Concept. The measures of task self-concept were adapted directly from the Computer Attitude Scale (CAS) developed by Gressard and Loyd (1986). A pilot test of the task self-concept (confidence, anxiety) instruments (of 37 community college faculty) revealed that its scores were highly reliable: three internal consistency estimates of reliability were computed: an overall reliability for all 10 items (alpha = .92), a reliability for the 5 confidence variables (alpha = .85), and a reliability for the 5 anxiety variables (alpha = .94).

Value of Computers

The survey form VALUE OF COMPUTERS asked faculty to weigh the factors importance, interest, and utility. The questionnaire is composed of 13 questions soliciting

subjects' levels of agreement with statements about their self-reported rating of the utility and importance of computers for instruction, as well as their personal interest in computer technology. They were asked to rate each statement (e.g., Technology will enable me to reach more students) 1 - strongly disagree, 2 - disagree, 3 - agree, or 4 - strongly agree (Appendix C).

Scale Development: Value of Computers. Principal components analysis was conducted to develop scale scores reflecting individuals' perceptions of the various domains of value of computers tapped by the set of questions. A pilot test of the administrative support instrument as well as the task-self-concept and value of computers instruments was performed using all the teachers and administrators at a Los Angeles area Catholic High School, and a second pilot test used a 50% random sample of faculty from one California Community College. The same criteria were used for item selection and factor identification as the administrative support instrument, and the same assumptions were made.

The second pilot test, following revision of the instrument, resulted in two factors with eigenvalues greater than 1.0 accounting for 75.3% of the variance in the set of 13 items. The items grouped into two factors, each composed of conceptually similar items representing interest/importance (8 items), and utility (5 items).

The second pilot test of the instrument revealed that its scores were reliable: two internal consistency estimates of reliability were computed: an overall reliability for all 13 items (alpha = .95), a reliability for the 8 interest/importance variables (alpha = .93), and a reliability for the 5 utility variables (alpha = .93).

Expectancy (Competency)

The survey form COMPUTER COMPETENCY MULTIPLE DOMAINS (CCMD) (Appendix C) is designed to determine a computer user's competency in two specific categories: hardware and software (Dusick, 1998b). The software category is broken down into eight domains: word processing, spreadsheet applications, database applications, Internet, educational software, statistics, multimedia, and presentations/publishing. The hardware category is broken down into four domains: operating systems, networking, programming, and repair. The self-reported Likert-type scale includes the designated alternatives: 1 - not familiar, 2 - somewhat familiar, 3 - somewhat proficient, 4 - proficient.

Scale Development: Expectancy (Competency). A pilot test was performed using 105 elementary, junior high school, high school, community college, undergraduate and graduate university teachers. Principal components analysis was conducted to develop scale scores reflecting individuals' perceptions of the various domains of computer competency tapped by the set of questions.

Content analysis and principle components analyses were employed using SPSS to analyze the underlying factor structure of teacher responses to the 71-item questionnaire. Because of the large number of items, two principle components analyses were conducted: one on the software domains, and one on the hardware and 'firmware' (software integral to the functioning of the computer, such as the operating systems) domains. Three criteria were used to determine the number of factors to rotate: the a priori hypothesis that the measure was multidimensional, the eigenvalues of the factors, and the interpretability of the

factor solution. The criteria indicated that the initial hypothesis of multiple dimensions was confirmed. Consequently, four factors were rotated on the hardware/'firmware' domains, and eight factors were rotated on the software domains. An oblique rotation procedure was used because the factors were considered to be correlated.

The range of item loadings for software was from .368 to .982, and for hardware/firmware from .427 to .961. The rotated solutions revealed that the various categories were indeed unique factors, although two of the original domains needed to be revised. First, the competencies theoretically identified as telecommunications and web browsing were identified as one factor, and were subsequently combined into the Internet category, and second, the troubleshooting/repair and peripherals competencies were identified as one factor, and were subsequently combined to a single Repair/Peripherals domain. Table 2A indicates the factor loadings for the software domains, and Table 2B indicates the factor loadings for the hardware/firmware domains.

Three internal consistency estimates of reliability were computed: an overall reliability for all 71 items (alpha = .98), a reliability for the 44 software variables (alpha = .97), and a reliability for the 27-hardware/firmware variables (alpha = .95). These statistics support the reliability of the sample.

For purposes of this study, 10 questions were selected from the original 71 items in order to reduce the size of the complete survey.

Table 2A

Factor Loadings For The Software Domains

Pattern Matrix

Component:	1	2	3	4	5	6	7	8
NET09 customize browser	.827							
NET07 Internet tools	.823							
NET03 download	.817							
NET02 attach_ftp_file	.806							
NET08 bookmarks	.799							
NET06 access Internet	.798							
NET01 e-mail	.785							
NET05 select ISP	.763							
NET10 plugins	.639							
NET04 live-interactive	.484							-.360
WORD5 advanced functions	.368							
STAT3 multivariate analyses		.982						
STAT1 basic statistics		.954						
STAT4 syntax files		.936						
STAT5 SEM		.885						
STAT2 statistical graphs_charts		.817						
MEDIA3 video editing			.832					
MEDIA2 animations			.781					
MEDIA4 audio editing			.754					
MEDIA1 3-D graphics			.743					
DATA2 create/edit fields				.724				
DATA1 create database				.707				
DATA4 database report				.690				
DATA3 input data				.686				
DATA5 merge database/spreadsheet				.585				
WORD1 create doc					.952			
WORD3 formatting					.939			
WORD2 simple edits					.892			
WORD4 complex tasks					.745			
ED3 drill and practice						.925		
ED1 tutorial						.849		
ED2 simulation						.772		
ED4 own programs						.551		
SPREAD2 format worksheets							.907	
SPREAD1 create/open worksheets							.889	
SPREAD4 spreadsheet reports							.873	
SPREAD3 formulas							.865	
PUB3 WYSIWYG_Web								-.846
PUB7 html_java_etc								-.767
PUB4 drawing								-.576
PUB5 photoshop								-.564
PUB6 advanced slide presentation								-.447
PUB2 newsletters, etc								-.431
PUB1 slide presentations								-.369

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.
Rotation converged in 12 iterations.

Table 2B

Factor Loadings For The Hardware/Firmware Domains

Pattern Matrix

Component:	1	2	3	4
REPAIR9 upgrade hardware	.899			
REPAIR8 upgrade software	.891			
REPAIR7 basic hardware problems	.875			
REPAIR6 basic software problems	.796			
REPAIR5 install sound card	.706			
REPAIR3 camera/mic	.608			
REPAIR4 digital camera	.577			
PGM3 write complex program		.956		
PGM6 debug a program		.910		
PGM4 program in more than one lang		.904		
PGM2 write a simple program		.903		
PGM1 read a program		.888		
PGM5 program multiple platforms		.857		
NETWORK5 hubs, switchers, routers			-.957	
NETWORK6 cat-5 wiring			-.818	
NETWORK4 configure server			-.681	
NETWORK7 install printers on network			-.647	
NETWORK3 install client software			-.646	
NETWORK2 select printer on Intranet			-.494	
NETWORK1 access Intranet files			-.480	
OPSYS1 use operating system				.961
OPSYS2 more than one op sys				.925
OPSYS4 shortcut keys				.872
OPSYS3 multitasking				.845
REPAIR1 fax/modem				.559
OPSYS5 configure a desktop				.540
REPAIR2 scanner	.402			.427

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 9 iterations.

Computer Use

The survey form COMPUTER USE BY FACULTY (Appendix D) is a self-report by faculty indicating how many ways they use computers in the classroom (Dusick, 1998b). The survey includes eight traditional methods and leaves one question for 'other' methods of instructional use in the classroom. A Likert-type scale allows faculty to indicate how often they use the method: 1 - never, 2 - sometimes, 3 - often, 4 - daily, and 5 - daily+ (more than once per day). The survey also includes nine traditional methods of faculty computer use outside the classroom, and one category for 'other'. The same Likert-type scale is used.

A pilot test of 40 California Community College faculty indicated a high reliability of observed scores for the sample (Cronbach's alpha = .95).

Data Analysis

This study uses both descriptive statistics and inferential statistics to investigate the existence and extent of relationships among selected variables. To determine if the a priori model is supported by the sample data, path analysis is conducted in this study. Descriptive statistics such as frequencies, means, and standard deviations for each scale are generated using the statistical software package SPSS.

The alpha for each scale is computed using SPSS to determine internal reliability. An alpha of greater than .60 is considered to be reliable. Principal components analysis will be used to confirm the factors determined in the pilot studies. The zero-order correlation with each endogenous variable in the model will be generated with SPSS to assess predictive validity.

The focus in this study is on the relationship of administrative support for computer technology, task self-concept, value of computers, and expectancy, with faculty use of computers, which will be operationalized with the measures described above. One-way analysis of variance (ANOVA) will determine if the results support the hypothesis that there are differences in perceived level of support at schools with high and low actual levels of support.

Ordinary Least Squares (OLS) regression in a path analysis design will determine if the results support the hypotheses that: (a) faculty perceptions mediate the effects of administrative support for computer technology on motivational beliefs; (b) task self-concept mediates the effects of perception on value of computers and competence; and

(c) value of computers and competence mediate the effects of task self-concept on computer use for instruction. The software program EQS 5.3 will be used to generate the path analysis. The path analysis permits comparison between the direct and indirect effects of the independent variables of faculty perception of support, task self-concept, value of computers, and competency on computer use.

Table 3

Summary Of Measures

Construct	Measure	Designer	# Of Items	∀	Correlation With Use
Administrative Support	Administrative support for computers in the classroom: subscales: 1. Equipment 2. Tech. Support 3. Morale Building 4. Training	Dusick	17	.93	.02
Faculty Perception of Administrative Support	Administrative support for computers in the classroom: subscales: 1. Equipment 2. Tech. Support 3. Morale Building 4. Training	Dusick	17	.93	.18
Task Self-Concept	Task Self-Concept: subscales: 1. Anxiety 2. Confidence	Gressard & Loyd	10	.92	.56
Value of Computers	Value of Computers: Subscales: 1. Utility 2. Interest 3. Importance	Dusick	13	.95	.59
Expectancy	Computer Competency Multiple Domains (CCMD)	Dusick	10	.98	.77
Computer Use for Instruction	Computer Use By Faculty subscales: 1. In-classroom use 2. Out-of-classroom use	Dusick	19	.95	1.00

CHAPTER IV

RESULTS

Introduction

In this chapter, observed outcomes are analyzed in the context of the research questions presented in Chapter One. Statistical findings are interpreted in relation to the extent to which they supported or failed to support the research hypotheses. As all five research hypotheses specifically predicted the direction of relationship among the variables of interest, findings are evaluated in relation to the one-tailed significance tests of zero-order correlation coefficients consistent with the directional nature of the hypotheses. Results are discussed within the context of the motivational model presented as the conceptual framework of this investigation.

The first section of the chapter presents the construct validity and reliability with principal components analysis and reliability analysis of each measure. The second section presents the descriptive statistics of observed variables, and examines the relationships among observed variables. The third section presents the results of the one-way analysis of variance (ANOVA) to determine if the results support the hypothesis that there are differences in perceived level of support at schools with high and low actual levels of support. The fourth section presents the results of the path analysis.

Construct Validity and Reliability

Principal Components Analysis

To test for construct validity of the independent variables, a principal components analysis was performed on these items using an oblique rotation, which assumes the factors are correlated. The following criteria were used for item selection and factor

identification: (a) only items with factor loadings greater than .30 in absolute value were retained; (b) items with loadings .30 on two or more factors were deleted, unless the two factors were hypothesized to be part of a larger construct (e.g., student equipment and faculty equipment); and (c) factors had to be composed of at least 3 items with loadings at .30. Items on each factor were then examined for conceptual consistency, and inconsistent items were deleted. Questions on anxiety were reverse-coded to be consistent with the questions on confidence. See Table 4.

The principal components analysis yielded seven factors with eigenvalues greater than 1.0 that accounted for 68% of the variance, closely reproducing the a priori scales, indicating a high level of construct validity. Faculty perception of administrative support yielded four factors as predicted. However, the equipment and technical support factors combined into two factors, which are more clearly identified as 'student equipment' and 'faculty equipment'. Morale building and training were separate factors, as predicted. Self-concept yielded one factor combining confidence and anxiety. Value of computers yielded only one factor: utility. The questions predicted to yield the factors of 'importance' and 'interest' loaded on multiple factors and are dropped from further analysis. Five questions from the competence survey yielded one factor. The other five questions loaded on more than one factor and are dropped from further analysis.

Internal Consistency and Reliability Measures

All of the factors and subscales had high internal consistency reliabilities. Faculty indicated their level of agreement to statements pertaining to administrative support, self-concept, value of computers, competence, and their use of computers for instruction.

Five scale scores were computed: administrative support (14 items), self-concept (8 items), value of computers (6 items), competence (5 items), and use (19 items).

The instrument measuring faculty perception of administrative support was found to be reliable: four internal consistency estimates of reliability were computed: an overall reliability for all 14 items (alpha = .86), a reliability for the 4 training variables (alpha = .85), a reliability for the 3 student equipment variables (alpha = .72), a reliability for the 4 faculty equipment variables (alpha = .75), and a reliability for the 3 morale building variables (alpha = .82).

The instrument measuring task self-concept was found to be reliable: three internal consistency estimates of reliability were computed: an overall reliability for all 8 items (alpha = .90), a reliability for the 4 confidence variables (alpha = .83), and a reliability for the 4 anxiety variables (alpha = .87).

The instrument measuring value of computers was found to be reliable: reliability for all 6 utility items (alpha = .92). The instrument measuring competence was found to be reliable for all 5 items (alpha = .86).

The instrument measuring computer use was found to be reliable: three internal consistency estimates of reliability were computed: an overall reliability for all 19 items (alpha = .91), a reliability for the 9 in-classroom use variables (alpha = .86), and a reliability for the 10 outside-the-classroom use variables (alpha = .87).

Table 4

Pattern Matrix of the Independent Variables

	Confidence	Training	Value of computers	Student Equip.	Comp.	Morale	Fac. Equip.	Anxiety
Feel OK about trying new problem on computer	.819							
Can do advanced computer work	.673							
Don't find learning new computer applications difficult	.540							
I am the type to do well with computers	.501							.462
Training in the effective uses of technology		.881						
Provides follow-up consultation with an expert after training		.811						
Provides on-campus training		.770						
Training when faculty are available		.610				.329		
With technology I can address student interests better			-.871					
With technology I can provide individualized feedback			-.858					
Believe computers are effective teaching tools			-.845					
With technology I can address different learning styles better			-.820					
Technology will enable me to reach more students			-.802					
Using computers in the classroom is worthwhile			-.727					
Maintains computer laboratories				-.895				
Maintains classroom computers				-.772				
Equipment in open computer laboratories				-.621				
Alter or manipulate pictures					.890			
Use a scanner					.844			
Create own programs for instruction					.705			
Create basic slide presentations					.689			
Upgrade hardware					.504			
Release time, flex credit, compensation for development						.819		
Release time, compensation for technology training						.798		
Compensates faculty for time spent developing and incorporating technology						.678		
Equipment to individual faculty							-.812	
Maintains faculty computers							-.660	
Equipment for faculty to produce multimedia							-.628	
Call-in technical support for all faculty		.449					-.481	
Feel threatened when others talk about computers								.922
Computers make me feel uncomfortable								.750
Working with computers makes me nervous								.745
Get confused when working on a computer								.610

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.
Rotation converged in 18 iterations.

Summary of Observed Variables: Faculty

Participants in this study were full time faculty (N = 451) at seven southern California community colleges teaching in science, humanities, social science, business, health sciences, technical (e.g., welding, automotive, etc.), library science, and physical education. Return rates for departments or divisions ranged from 15% to 100%, and return rates school-wide ranged from 50% to 93%, with an overall return rate of 62%. See Table 5.

Three demographic, categorical variables were examined in the study: gender, highest degree, and number of years teaching. The respondents to this survey were relatively evenly distributed by gender (48% female, 47% male, 5% not reporting). The respondents' highest degree was primarily a master's degree (65%), with relatively even distribution among other degrees. See Table 6. Fifty-three percept of the respondents began teaching prior to 1985, with the rest of the respondents spread relatively evenly throughout 1986 - 1998 (Table 7).

Means, variances, and standard deviations of the observed variables for the sample are presented in Table 8. The statistics indicate that the sample is normally distributed on all variables.

One-tailed Pearson Product Moment Correlation Coefficients were used to determine the statistically significant zero-order correlations because the directions of the correlations were stated a priori. Table 9 reveals that faculty perception of administrative support for computer technology (perception of support) is significantly and positively related to value of computers, but no other variable in the model. All other variables (self-concept, value of computers, competence, and use of computers for instruction)

were significantly and positively related to all other variables in the model at the .01 level, with the amount of variance explained ranging from 8% (value of computers and competence) to 39% (competence and use).

Table 5

Summary of Respondents By School and Discipline

School	Discipline	N	% Responding	% Male	% Female
1	Science	29	.73	.52	.48
	Humanities	18	.88	.41	.59
	Social Sci.	9	.56	.56	.44
	Business	13	.87	.62	.38
	Health Sci.	14	.78	0	1.00
	Technical	10	.67	1.00	0
	Library	3	1.00	0	1.00
	TOTAL	96	.73	.47	.53
2	Science	3	1.00	.33	.67
	Humanities	5	1.00	.80	.20
	Social Sci.	2	.67	.50	.50
	PE	2	.50	1.00	0
	Health Sci.	5	.50	.50	.50
	TOTAL	17	.68	.60	.40
3	Science	14	.93	.46	.54
	Humanities	11	.92	.11	.89
	TOTAL	25	.93	.32	.68
4	Science	2	.67	1.00	0
	Humanities	5	.71	1.00	0
	PE	1	.33	1.00	0
	Business	2	.67	.50	.50
	TOTAL	10	.62	.90	.10
5	Science	10	.67	.63	.37
	Humanities	7	.88	.43	.57
	TOTAL	17	.74	.53	.47
6	Science	17	.85	.62	.38
	Humanities	3	.15	.67	.33
	TOTAL	20	.50	.63	.37
7	Science	24	.92	.50	.50
	Humanities	27	.48	.20	.80
	Social Sci.	10	.24	.50	.50
	PE	3	.23	0	1.00
	Business	8	.67	.63	.37
	Health Sci.	9	.53	.11	.89
	Technical	8	.62	.83	.17
	Library	4	1.00	.50	.50
	TOTAL	93	.51	.61	.39
TOTAL		278	.62		

Table 6

Highest Degree

	Frequency	Percent	Valid Percent	Cumulative Percent
B.A./B.S.	17	6.1	6.7	6.7
2 M.A./M.S./M.F.A.	164	59.0	65.1	71.8
2 or more Masters	29	10.4	11.5	83.3
Ed.D.	7	2.5	2.8	86.1
Ph.D.	35	12.6	13.9	100.0
Total	252	90.6	100.0	
Missing	26	9.4		
Total	278	100.0		

Table 7

First Year Teaching

	Frequency	Percent	Valid Percent	Cumulative Percent
1998-99	3	1.1	1.1	1.1
1997	4	1.4	1.5	2.7
1996	4	1.4	1.5	4.2
1995	6	2.2	2.3	6.5
1994	10	3.6	3.8	10.3
1993	10	3.6	3.8	14.2
1992	10	3.6	3.8	18.0
1991	11	4.0	4.2	22.2
1990	16	5.8	6.1	28.4
1989	15	5.4	5.7	34.1
1988	11	4.0	4.2	38.3
1987	6	2.2	2.3	40.6
1986	10	3.6	3.8	44.4
1985	7	2.5	2.7	47.1
prior to 1985	138	49.6	52.9	100.0
Total	261	93.9	100.0	
Missing	17	6.1		
Total	278	100.0		

Table 8

Summary of Sample Statistics

	Faculty Perception of Support	Self-concept	Value of computers	Competence	Use of Computers for Instruction
N	277	278	278	278	278
Missing	1	0	0	0	0
Mean	2.41155	2.92206	3.11511	2.14793	2.12893
Std. Deviation	.52566	.64954	.56727	.85037	.69468
Variance	.27631	.42190	.32079	.72313	.48258
Skewness	.095	-.298	-.571	.430	.876
Std. Error of Skewness	.146	.146	.146	.146	.146
Kurtosis	.349	-.218	.555	-.923	.961
Std. Error of Kurtosis	.292	.291	.291	.291	.291

Table 9

Correlations of Independent and Dependent Variables

		Perception of Support	Self-concept	Value of computers	Competence	Use of Computers
Perception of Support	Pearson Correlation	1.000	-.010	**.197	-.005	.021
	Sig. (1-tailed)	.	.432	.000	.464	.364
	N	277	277	276	277	277
Self-concept	Pearson Correlation	-.010	1.000	**.377	**.553	**.535
	Sig. (1-tailed)	.432	.	.000	.000	.000
	N	277	278	277	278	278
Value of computers	Pearson Correlation	**.197	**.377	1.000	**.281	**.418
	Sig. (1-tailed)	.000	.000	.	.000	.000
	N	276	277	277	277	277
Competence	Pearson Correlation	-.005	**.553	**.281	1.000	**.626
	Sig. (1-tailed)	.464	.000	.000	.	.000
	N	277	278	277	278	278
Use of Computers	Pearson Correlation	.021	**.535	**.418	**.626	1.000
	Sig. (1-tailed)	.364	.000	.000	.000	.
	N	277	278	277	278	278

** Correlation is significant at the 0.01 level (1-tailed).

Summary of Observed Variables: Schools

Forty-four southern California community colleges were invited to participate in the study. Eleven agreed to participate. Seven colleges were selected based on the following criteria: (a) at least one urban and one rural school were included, (b) small, medium, and large schools, based on enrollment, were included, (c) at least one school with a self-reported high level of administrative support and one school with a self-reported low level of administrative support were included. See Table 10A. Four schools were eliminated from consideration due to scheduling constraints, leading to an inability to arrange department or division meetings.

Table 10A

Summary of Colleges

College	Location	Size	FTES	Level of Technology
1	Urban	Medium	Over 10,000	High
2	Suburban	Small	Less than 6,000	Medium
3	Suburban	Medium	Over 10,000	Low
4	Rural	Small	Less than 4,000	Low
5	Suburban	Medium	Over 10,000	High
6	Urban	Large	Over 20,000	High
7	Urban	Medium	Over 10,000	Medium

Administrative Support

Schools were divided into high, medium, and low support, based on current availability of computer laboratories for individual departments or divisions included in the study, a faculty development room, availability of technical staff and training on campus, faculty access to personal computers, Internet classroom connections, and 'smart carts' (mobile carts with computers). See Table 10B.

Table 10B

Level of Administrative Support for Computer Technology

College	Labs for Departments	Faculty Dev. Room	Tech. Staff	Training Staff On Campus	Internet Connections in Classrms	Faculty Computers	Smart Carts	Support
1	Multiple	No	Yes	Limited	Yes	Yes	Multiple	High
2	Few	Yes	Limited	Limited	No	Some	Yes	Medium
3	No	Yes (small)	Yes	No	No	No	Few	Low
4	One	No	Yes	Limited	Limited	Most	No	Low
5	Shared	Yes	Yes	Yes	Yes	Yes	Yes	High
6	Yes	No	Yes	Yes	Yes	Yes	No	High
7	Limited	Yes	Yes	Limited	No	Yes	Few	Medium

One Way Analysis of Variance

QUESTION 1: Is there a relationship between level of support for technology and the faculty's perception of administrative support for computer technology?

A one-way analysis of variance (ANOVA) was performed to determine if faculty perception of administrative support for computer technology is significantly different at high-, medium-, and low-support schools. The results indicate that there is a significant difference ($F_{(2,274\ df)} = 3.812$, $p = .023$) and consequently, the one-way ANOVA was followed by Scheffe tests of paired comparisons. These tests indicated that faculty at schools with low support accurately perceive lower levels of support than at schools with more support. See Tables 11A and 11B.

QUESTION 2: Is there a relationship between the faculty's perception of administrative support in each of the following factors: (a) faculty equipment, (b) morale building, (c) faculty training, and (d) student equipment and the use of computers in the classroom by community college faculty?

There are no significant correlations between the faculty's perception of administrative support in any area and the use of computers in the classroom by community college faculty when all schools are included in the model, or when only low-support schools are included. See Tables 12 and 12B.

However, when only high-support schools were included in the model, 'equipment for faculty' was positively and significantly correlated with use in the classroom ($r = .184$, $p < .05$), and total use ($r = .159$, $p < .05$). 'Equipment for students' was also positively and significantly correlated with use in the classroom ($r = .226$, $p <$

.01), use outside the classroom (r= .159, p < .05), and total use (r = .214, p < .01). In all cases, however, less than 5% of the variance is explained. See Table 12A.

Table 11A

Relationship Between Actual Support and Faculty Perception of Support for Computer Technology: Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
.000 low	35	2.19592	.49770	8.4126E-02	2.02495	2.36688	1.286	3.500
1.000 medium	110	2.42468	.48211	4.5968E-02	2.33357	2.51578	1.143	4.000
2.000 high	132	2.46753	.55296	4.8129E-02	2.37232	2.56274	1.214	4.000
Total	277	2.41619	.52429	3.1501E-02	2.35418	2.47821	1.143	4.000

Table 11B

Relationship Between Actual Support and Faculty Perception of Support for Computer Technology

		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
(I) ADMIN	(J) ADMIN				Lower Bound	Upper Bound
Scheffe .000 low	1.000 medium	-.22876	.101	.078	-.47666	1.9148E-02
	2.000 high	-.27161	.099	*.024	-.51448	-2.87466E-02
1.000 medium	.000 low	.22876	.101	.078	-1.91483E-02	.47666
	2.000 high	-4.28571E-02	.067	.815	-.20777	.12206
2.000 high	.000 low	.27161	.099	*.024	2.8747E-02	.51448
	1.000 medium	4.2857E-02	.067	.815	-.12206	.20777

* The mean difference is significant at the .05 level.

Table 12

Correlations Between Faculty Perception of Support for Computer Technology and Computer Use

		Use In the Classroom	Use Outside the Classroom	Total Use
Equipment for Faculty	Pearson Correlation	.051	.008	.031
	Sig. (2-tailed)	.400	.890	.602
	N	277	277	277
Equipment for Students	Pearson Correlation	.011	-.004	.003
	Sig. (2-tailed)	.854	.943	.957
	N	265	265	265
Morale Building	Pearson Correlation	-.095	-.114	-.118
	Sig. (2-tailed)	.118	.061	.053
	N	270	270	270
Training	Pearson Correlation	-.051	-.019	-.038
	Sig. (2-tailed)	.394	.750	.526
	N	276	276	276

Table 12A

Correlations: High- Support Schools

		Use in the Classroom	Use Outside the Classroom	Total Use
Equipment for Faculty	Pearson Correlation	*.184	.107	.159
	Sig. (1-tailed)	.017	.111	.034
	N	132	132	132
Equipment for Students	Pearson Correlation	**.226	.159	**.214
	Sig. (1-tailed)	.006	.039	.009
	N	124	124	124
Morale Building	Pearson Correlation	.042	-.010	.014
	Sig. (1-tailed)	.318	.455	.436
	N	129	129	129
Training	Pearson Correlation	.068	.068	.077
	Sig. (1-tailed)	.219	.219	.191
	N	131	131	131

** Correlation is significant at the 0.01 level (1-tailed).
* Correlation is significant at the 0.05 level (1-tailed).

Table 12B

Correlations: Low- Support Schools

		Use in the Classroom	Use Outside the Classroom	Total Use
Equipment for Faculty	Pearson Correlation	.033	-.204	-.107
	Sig. (1-tailed)	.426	.120	.271
	N	35	35	35
Equipment for Students	Pearson Correlation	-.179	-.237	-.233
	Sig. (1-tailed)	.155	.088	.093
	N	34	34	34
Morale Building	Pearson Correlation	-.169	.045	-.057
	Sig. (1-tailed)	.170	.399	.374
	N	34	34	34
Training	Pearson Correlation	-.213	-.142	-.192
	Sig. (1-tailed)	.109	.207	.134
	N	35	35	35

** Correlation is significant at the 0.01 level (1-tailed).
* Correlation is significant at the 0.05 level (1-tailed).

Path Analysis

QUESTION 3: Are there relationships among the cognitive processes (i.e., level of faculty's perception of administrative support) and motivational beliefs (task-specific self-concept, value of computers, and expectancy)?

The results indicate that faculty perception of administrative support is significantly correlated only with value of computers ($r = .197$, $p < .001$). See Table 9. However, less than 4% of the variance is explained. A complex relationship among faculty perception of administrative support, task self-concept, and value of computers was discovered. See the following discussion that examines the relationship of cognitive processes and motivational beliefs when colleges are grouped by level of support (high, medium, low).

QUESTION 4: Is there a relationship between motivational beliefs (task-specific self-concept, value of computers, and expectancy) and computer use by community college faculty?

The results indicate that there are positive and significant correlations between each of the motivational beliefs and computer use for instruction. See Table 9. Further, the path analyses performed with all schools, high-support, and low-support schools indicate that value of computers and competence mediate the relationship between task self-concept and computer use. See the following discussion.

Path Analysis: Total Sample

The major focus of this study was on the path coefficients for the a priori model of faculty motivation. However, the Pearson Product Moment Correlation Coefficient (PPMCC) between faculty perception of administrative support and self-concept was not

significant, while the PPMCC between perception of support and value of computers was significant. Because the purpose of this study is exploratory, the path analysis was revised to include a path from faculty perception of administrative support to value of computers, based on the significance of the PPMCC.

The path coefficient from actual support to faculty perception of support was consistent with prediction: positive and significant, though it had a small effect size (.14). It is quite probable however, that the small size of the path coefficient is due more to the low power of the test because of only 3 levels of support, than to the actual effect.

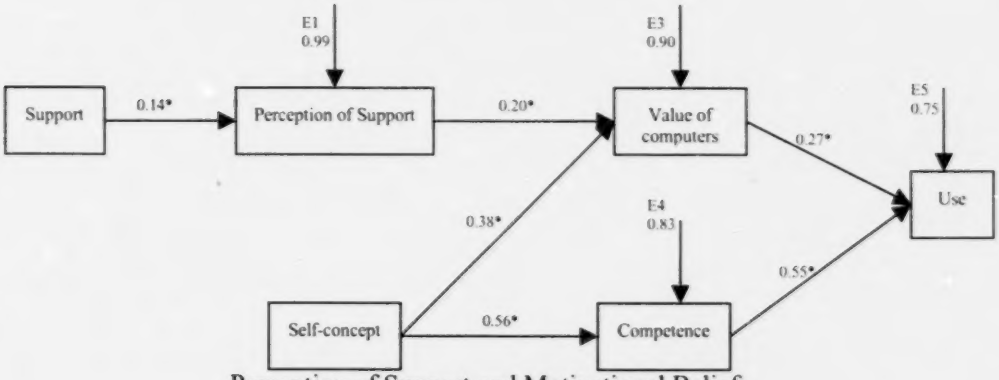
The path coefficient from perception of support to value of computers was positive and significant (.20), while path coefficients from self-concept to value of computers and competence were consistent with predictions: positive, significant, and of moderate to large size (.38 for value of computers and .56 for competence). These results indicate that the relationship between self-concept and achievement behavior was mediated by value of computers and competence.

Path coefficients from value of computers and competence to use were consistent with predictions: positive and significant, (.27 for value of computers and .55 for competence), however, the effect of competence was twice the effect of belief in the value of computers. See Figure 4.

Indirect Effects of Self-Concept. An indirect effect is the effect of an independent variable on another variable through the mediation of one or more intermediary variables (Pedhazur, 1997, p. 767). As seen in the path diagram, task self-concept does not have a direct effect on computer use, but does exhibit an indirect effect through both value of computers and competence. The indirect effect is calculated by summing the product of

the path coefficients leading from the "cause variable" to the "effect variable". For the indirect path between task self-concept and value of computers and competence, the value was calculated as (0.38)(0.27) + (0.56)(0.55) = .10 + .31 = .41. This is slightly less than the PPMCC (r = .535) between self-concept and computer use. The difference may be accounted for by a small direct effect, as well as measurement error. The size of the indirect effect of self-concept is stronger than the direct effect of belief in the value of computers.

Figure 4. Revised Model of Motivational Factors Influencing Faculty Use of Computers



Perception of Support and Motivational Beliefs

Because the relationship between faculty perception of administrative support and task self-concept was not significant as predicted, but the relationship between perception of support and value of computers was significant, further examination of the variables was warranted. Further, because the purpose of this study is exploratory, two additional path analyses were performed: first including the three schools with high support (n = 133), then the two schools with low support (n = 35). To determine whether a path should be included from faculty perception of support to value of computers or to self-concept, the correlation matrix was examined.

A weak interaction effect was discovered only high and low rated schools were included in the analysis. See Figure 5. When one outlier was removed from the low-support schools, R squared increased from .08 to .18 (Figure 5a).

The results indicate that when support for computer technology is low, there is a negative relationship between faculty perception of support and value of computers. In other words, the more faculty value technology at a school with low support, the more they are likely to notice that there is little support at the school. The amount of variance explained however (r^2 = .18) is relatively small. The more faculty value technology at a school with high support, however, the more they are likely to notice that there is high support at the school, although, again, the amount of variance explained is small (r^2 = .15).

Figure 5:

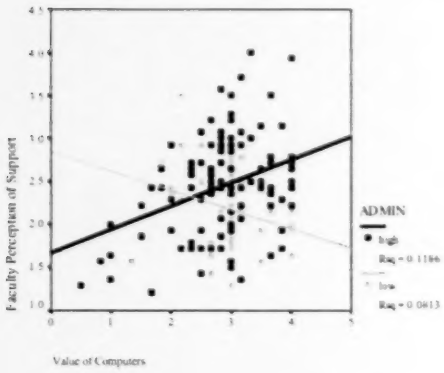


Figure 5A:

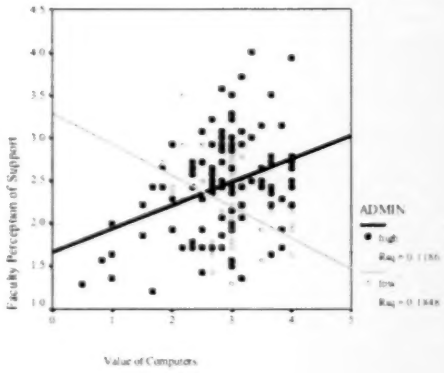


Figure 5 and 5A. Relationship of Faculty Perception of Support to Value of Computers

Path Analysis: High Support

Because the interaction effect indicates that there is a difference in the relationships among variables in high support and low support schools, the path analysis was replicated using only the schools in each group. The PPMCC between faculty

perception of administrative support and self-concept was not significant, while the PPMCC between perception of support and value of computers was significant. The path analysis therefore includes a path from faculty perception of administrative support to value of computers, based on the significance of the PPMCC ($r = .323$. $p < .001$). See Table 13.

Table 13

Correlations: Schools with High Administrative Support for Computer Technology

		Perception of Support	Self-concept	Value of computers	Competence	Use
Perception of Support	Pearson Correlation	1.000	.061	**.323	.120	**.222
	Sig. (1-tailed)	.	.242	.000	.084	.005
	N	132	132	132	132	132
Self-concept	Pearson Correlation	.061	1.000	**.312	**.562	**.512
	Sig. (1-tailed)	.242	.	.000	.000	.000
	N	132	133	133	133	133
Value of computers	Pearson Correlation	**.323	**.312	1.000	**.280	**.467
	Sig. (1-tailed)	.000	.000	.	.001	.000
	N	132	133	133	133	133
Competence	Pearson Correlation	.120	**.562	**.280	1.000	**.600
	Sig. (1-tailed)	.084	.000	.001	.	.000
	N	132	133	133	133	133
Use	Pearson Correlation	**.222	**.512	**.467	**.600	1.000
	Sig. (1-tailed)	.005	.000	.000	.000	.
	N	132	133	133	133	133

** Correlation is significant at the 0.01 level (1-tailed).

The path coefficient from perception of support to value of computers was positive and significant (.31), and was greater than the path coefficient when all the subjects were included in the model (.20). Path coefficients from self-concept to value of computers and competence were consistent with predictions: positive, significant, and of moderate to large size (.29, down from .38 for value of computers, and .58, up from .56 for competence). Path coefficients from value of computers and competence to use were consistent with predictions: positive, significant, and of moderate to large size (.33, up

from .27 for value of computers, and .52, down from .55 for competence), indicating that the relationship between self-concept and achievement behavior was mediated by value of computers and competence. Although the path coefficients indicate that the model is not significantly different for schools with high support than for all schools, the effect of value of computers by faculty at schools with high support has a stronger effect on computer use than when only high schools are included in the model. See Figure 6.

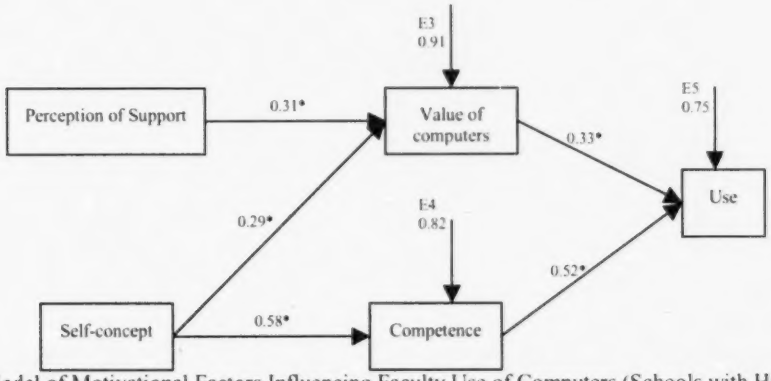


Figure 6. Model of Motivational Factors Influencing Faculty Use of Computers (Schools with High Support)

The path diagram indicates that task self-concept again has an indirect effect through both value of computers and competence. The indirect effect is calculated as (0.29)(0.33) + (0.58)(0.52) = .10 + .30 = .40. This is less than the PPMCC (r = .512) between self-concept and computer use. The difference may be accounted for by a direct effect, as well as measurement error. The size of the indirect effect of self-concept when support for computer technology is high is virtually identical to the indirect effect of anxiety when all schools are included in the model (r = .41).

Path Analysis: Low Support

The Pearson Product Moment Correlation Coefficient (PPMCC) between faculty perception of administrative support and self-concept was significant ($r = -.435$, $p < .001$), but negative, which is inconsistent with prediction (Table 14). However, because the nature of this study is exploratory, the path analysis was performed with a path included between perception of support and self-concept when actual support is low. This premise is consistent with the purpose of the study, which is to examine the effects of the exogenous variables on the dependent variable of computer use in the classroom. In the case of schools with low support, it is reasonable to assume that as faculty anxiety levels decrease and their level of use increases, they are likely to accurately perceive that support is low.

The path coefficient from self-concept to value of computers was consistent with prediction: positive, significant, and of large size (.50, up from .29 for high support schools, and up from .38 for all schools). The path coefficient from self-concept to competence was consistent with prediction: positive, significant, and of large size (.68, up from .58 for high support schools, and up from .56 for all schools).

The path coefficient from value of computers to use was consistent with prediction: positive, significant, and of moderate size (.36, up from .33 for high support schools, and up from .27 for all schools). The path coefficient from competence to use was consistent with prediction: positive, significant, and of large size (.58, up from .52 for high support schools, and up from .55 for all schools). These results indicate that the relationship between self-concept and achievement behavior is mediated by value of computers and competence. The path coefficients indicate that the model is slightly

different for schools with low support, and all but one of the significant paths are consistent with the a priori model.

The path diagram indicates that task self-concept again has an indirect effect through both value of computers and competence. The indirect effect is calculated as (0.50)(0.36) + (0.68)(0.58) = .18 + .39 = .57. This is higher than the PPMCC (r = .518) between self-concept and computer use. The difference may be accounted for by a negative direct effect, as well as measurement error. This negative direct effect may be explained by the fact that there is low support at the school - faculty who have more confidence with technology may be disinclined to use it as they discover the lack of support for technology. This hypothesis was tested by adding a direct path from self-concept to computer use (Figure 8). As predicted, the path is negative, but is not significant.

Table 14

Correlations: Schools with Low Administrative Support for Computer Technology

		Faculty Perception of Support	Self-concept	Value of computers	Competence	Use
Faculty Perception of Support	Pearson Correlation	1.000	**-.435	*-.285	-.207	-.172
	Sig. (1-tailed)	.	.005	.048	.116	.161
	N	35	35	35	35	35
Self-concept	Pearson Correlation	**-.435	1.000	**.497	**.680	**.518
	Sig. (1-tailed)	.005	.	.001	.000	.001
	N	35	35	35	35	35
Value of computers	Pearson Correlation	*-.285	**.497	1.000	*.348	**.566
	Sig. (1-tailed)	.048	.001	.	.020	.000
	N	35	35	35	35	35
Competence	Pearson Correlation	-.207	**.680	*.348	1.000	**.709
	Sig. (1-tailed)	.116	.000	.020	.	.000
	N	35	35	35	35	35
Use	Pearson Correlation	-.172	**.518	**.566	**.709	1.000
	Sig. (1-tailed)	.161	.001	.000	.000	.
	N	35	35	35	35	35

** Correlation is significant at the 0.01 level (1-tailed).
* Correlation is significant at the 0.05 level (1-tailed).

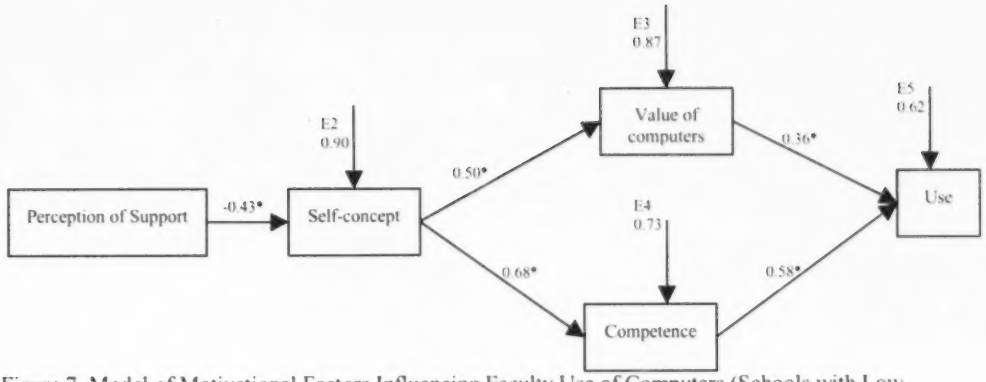


Figure 7. Model of Motivational Factors Influencing Faculty Use of Computers (Schools with Low Support)

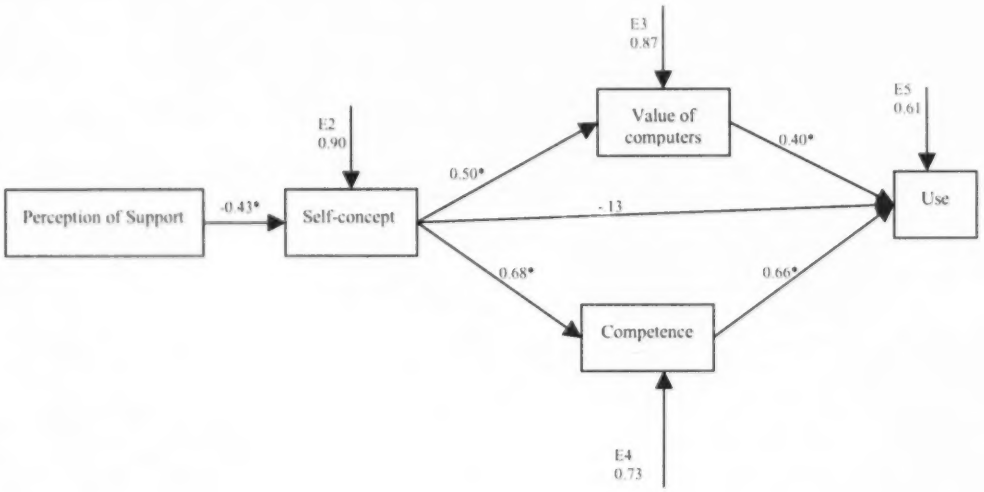


Figure 8. Revised Model of Motivational Factors Influencing Faculty Use of Computers (Schools with Low Support)

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter includes an introduction and review of the purpose of the study, a summary and discussion of the investigation, followed by a statement of conclusions and recommendations.

Introduction

The explosive growth of technology is challenging educational institutions to prepare students for the technological jobs of the twenty first century. This requires a fundamental change in education that demands that teachers use computer technology both to present material, and enhance students' technology skills. However, this is impossible if teachers are computer-phobic or computer-illiterate, or are unsupported by their school culture.

The Purpose of the Study

The purpose of this study was to determine whether there is a relationship between actual administrative support for technology, faculty perception of that support, and the subsequent use of computers in the classroom by community college faculty. In addition, the study examined whether variables representing task self-concept, value of computers, and expectancy, influenced their choice. Using data from a self-report survey gathered from seven California community colleges, scores from 278 full-time faculty were examined. Principal components analysis was used to evaluate the discriminant ability of the survey. One-way analysis of variance (ANOVA), one-tailed Pearson Product Moment Correlation Coefficients, and path analyses were used to examine the relationship among the variables.

Summary of Findings

Hypothesis 1: Faculty perception of administrative support will be significantly lower at schools with low actual support than at schools with high actual level of support.

A one-way analysis of variance (ANOVA) was performed to determine if faculty perception of administrative support for computer technology is significantly different at high- and low-support schools. Results of this investigation were consistent with the a priori prediction that faculty perception of administrative support is significantly lower at schools with low actual support than at schools with high actual level of support. Faculty at schools with low support accurately perceive lower levels than at schools with more support.

Hypothesis 2: Faculty perception of administrative support is significantly and positively related to the use of computers in the classroom by community college faculty.

Results of this investigation were inconsistent with the a priori predictions of the relationship between faculty perception of administrative support and use of computers for instructional purposes. When all schools were included in the model, and when only low-support schools were included, there were no significant correlations among faculty perception of administrative support (equipment for faculty or students, training, or morale building) and computer use in the classroom.

However, when only high-support schools were included in the model, 'equipment for faculty' was positively and significantly correlated with use in the classroom ($r = .184$, $p < .05$), and total use ($r = .159$, $p < .05$). 'Equipment for students' was also positively and significantly correlated with use in the classroom ($r = .226$, $p <$

.01), use outside the classroom ($r = .159$, $p < .05$), and total use ($r = .214$, $p < .01$). However, in all cases, less than 5% of the variance is explained.

Hypothesis 3: Faculty perception of administrative support is significantly and positively related to task-specific self-concept.

Results of this investigation were inconsistent with the a priori predictions with relationship to the influence of the educational environment and perceptions of that environment (cognitive processes) on self-concept. Rather, there appears to be a complex relationship between level of support, perception of that support, and motivational beliefs. The results indicate that a teacher's perception of support has influence on their confidence and anxiety levels in relation to technology only when support for IT at the school is low, as indicated by the path analyses.

In addition, the results indicate that there may be a weak interaction effect between the educational environment and a teacher's cognitive processes and their value of computers as measured by their belief in the usefulness of technology for instruction. This result was not expected.

Faculty in schools with a high level of support for technology had a positive relationship between their perception of support and value of computers. This may be explained by the fact that the higher a teacher values technology as an educational tool the more they are likely to use technology. The more a teacher uses technology the more they would require technical support and equipment. Clearly, if the school provides a high level of support, teachers who use more technology would perceive a high level of support.

The opposite effect was apparent in schools with a low level of support for technology: in these schools there was a negative relationship between faculty perception of support and value of computers. This may be explained by the fact that the more a teacher in these schools use technology, the more they would perceive the low level of support.

In addition, the hypothesis was not supported in relationship to low-support schools. Although faculty perception of administrative support was significantly related to task-specific self-concept, the relationship was weak and negative. In other words, in schools with low support, faculty with higher anxiety and lower confidence levels perceive administrative support to be high, while confident faculty accurately perceive support to be low. This result may be explained by the fact that faculty with high confidence and low anxiety are more likely to pursue technology interests on their own.

Hypothesis 4: Task specific self-concept is significantly and positively related to value of computers and expectancy.

Results of this investigation were consistent with the a priori predictions that task specific self-concept is significantly and positively related to value of computers and expectancy (competency). Previous research indicated the importance of confidence and anxiety as predictors of behavior. However, this research indicates that self-concept is mediated by value of computers and competence.

Path coefficients from self-concept to value of computers and competence were consistent with predictions in all three models: positive, significant, and of moderate to large size.

This result indicates that value of computers and competence act as mediating variables between task specific self-concept (anxiety and confidence) and achievement behavior (computer use in the classroom). This result has important implications for administrators and trainers. When individuals have high anxiety and low confidence levels, and are therefore reluctant to use computers for instruction, training may be more effective if it is aimed at developing competence and value of computers (i.e., the usefulness of computers for instruction), rather than on lowering anxiety. This finding is consistent with the recommendations of Olivier and Shapiro (1993), who found that performance accomplishments will raise self-efficacy to the point where it is taken for granted, and occasional failure then will mean much less.

Hypothesis 5: Value of computers and expectancy are significantly and positively related to computer use in the classroom.

Results of this investigation were consistent with the a priori predictions of the relationships among value of computers, competence, and use of computers for instructional purposes. The critical findings based on the a priori model were the relative sizes of paths associated with the independent variables and use of computers. In all three models value of computers and competence were significantly and positively related to computer use by community college faculty.

Discussion

Construct Validity

The results of the Principal Components Analysis support the conclusion that faculty perception of support, self-concept, value of computers, and competence are separate constructs which are correlated. Further, the path analyses support the

conclusion that these constructs mediate the efforts of administrators to influence faculty use of computers for instruction.

Administrative Support

This study found little relationship between a teacher's choice to use technology for instruction, and support for technology, or faculty perception of that support. As support increased, faculty beliefs that adequate equipment was available for faculty and students also increased, although the effect size was small. These results may be explained by the facts that: (a) the effect of perception of support is mediated by the individual's task self-concept, value of computers, and competence, and (b) the small effect size may be due to the low power of the test. Because the net effect is slight, it is important to examine other variables that have stronger correlations with the dependent variable.

Previous research over the last few decades has shown that administrative support is significantly related to the use of computers for instruction, and that an individual's educational and personal beliefs affect their behavior. According to diffusion theory (Rogers, 1995), an individual's communication network and the sociological system within which it operates is crucial to the adoption of an innovation. However, this study raises the question whether administrative support has a strong effect on faculty use of computers for instruction, or whether there are mediating variables. The fundamental premise of this study, that the influence of administrative support is mediated by faculty cognitive processes and motivational beliefs, was supported by the data.

While current research has identified numerous administrative support factors which influence faculty use of computers (e.g., lack of access to equipment, lack of

training and support, etc.), no studies have examined whether administrative effort should be directed at achievement behavior (i.e., use of computers), or at motivational beliefs (task self-concept, value of computers, computer competence).

Motivational Beliefs

Previous research has also shown that there are numerous cognitive and motivational factors that influence behavior. This study examines the relationship of key motivational factors and their combined effect on faculty use of computers for instruction, based on a previous model of achievement motivation. The correlational analyses revealed that all of the motivational beliefs variables examined (task self-concept, value of computers, and competency) were strongly and positively related to each other and to computer use for instruction.

Self-concept. Self-concept is noted in numerous studies as a significant variable in influencing computer use. For example, Pina and Harris (1994) stress strategies to lessen computer anxiety and increase computer confidence among teacher educators and teacher preparation programs, in order to increase the classroom use of computers. However, the current study found that the influence of anxiety and confidence on computer use is mediated by faculty beliefs in the value of computers as an instructional tool, and, even more significantly, a teacher's level of competence with computers. This influence increased when administrative support for technology was low.

The size of the indirect effect of self-concept on computer use is stronger than the direct effect of belief in the value of computers. The result is that anxiety and confidence have strong influence on computer use in the classroom, and high anxiety or low confidence, if not mediated by value and competence, will significantly decrease the use

of computers. However, even a small increase in value of computers or level of competence will mediate the effect of self-concept. These results are consistent with the hypothesized motivational model.

Findings of this study coincided with Byrne's (1996) hypothesis that self-concept affects subsequent achievement, and Eccles' model, which concludes that self-concept, is mediated by value of computers and competence. That the mediational effect occurred with both high- and low-support schools further supports this contention.

Value of Computers and Competence. Current research stresses the importance of computers in education and the need for computer literacy across the curriculum. Woodrow (1998) noted that technology provides information access to all students and teachers, provided they have the skills needed. This study confirmed the importance of teacher's beliefs in the value of computers, as well as level of competence. Path coefficients from value of computers and competence to use of computers for instructional purposes were positive and significant. However, the effect of competence was twice the effect of belief in the value of computers, indicating that a teacher who is competent with computer technology is more likely to use computers than one who is less competent, and that competence will influence a teacher's choice more than their belief in the value of computer technology as an instructional tool.

Conclusions

The pattern of findings highlights the influential role of self-concept, value of computers, and competency on use of computer technology. Although administrative support and perception of that support influence use, that influence is mediated by motivational beliefs. Despite the fact that these findings are based on self-reports, the

results are not unexpected given the theoretical and empirical literature suggesting that these variables are critical for the successful implementation of technology in the classroom.

While most findings were consistent with the a priori model, faculty perception of administrative support was not significantly related to task self-concept except when actual support was low, but was related significantly to value of computers, though the effect size was small. Further examination of the relationship between faculty perception of administrative support and value of computers revealed that there is an interaction effect: schools which provided high levels of administrative support had a significant and positive relationship between faculty perception of support and value of computers, while schools or departments with very low levels of administrative support had a significant and negative relationship between those two variables.

Findings consistent with the a priori model included a strong positive, significant relationship between task self-concept and value of computers, and task self-concept and competency with computers. In addition, there was a strong positive, significant relationship between both value of computers and competency and the dependent variable, computer use for instruction.

This study concludes that, in order to increase the amount of use of computers by faculty, both in and out of the classroom, two key factors must be addressed. First, faculty must believe in the utility of computers both for themselves and their students. Second, faculty must be competent in the use of computer technology. These two factors will mediate the affects of computer anxiety. Only if anxiety and lack of confidence

persist after competence and value have been addressed, should administrative efforts be directed at self-concept.

Recommendations

Implications

To the extent that these findings are generalizable to other community colleges, there are clear implications for administrators. Faculty perceptions of the level of support for computer technology were related to how they reported their value of computers for instruction. Although faculty were generally positive about the level of support, the interaction between their perceptions and their value of computers for instruction indicates that an effort should be made to provide training and ongoing support which demonstrates the utility of computers. Therefore, administrative efforts in training should (a) be provided by faculty who have already implemented computers in the classroom and (b) provide practical examples of methods and materials. However, trainers should not promote technology that the school cannot realistically support.

Further, if administrators and trainers expect to increase their faculty's use of computers for instruction, that training should concentrate on (a) competence and (b) the usefulness of computers, and (c) levels of anxiety and confidence. This can be achieved by (a) identifying effective strategies, (b) fine-tuning staff development programs, and (c) providing feedback and support mechanisms for their implementation.

Although many factors have been found in the literature to predict computer use for instruction, this study was important because it tested the relationship among predictor variables, and provided further evidence about the nature of environmental, cognitive, and motivational factors and their relationship to computer use. The

implications of the findings of this study are that: (a) administrators responsible for support for computer technology must consider whether and how much faculty value computers for instruction; (b) administrators must consider faculty level of competence with computers; and (c) administrators must consider faculty levels of confidence and anxiety in relation to computers in the classroom.

Recommendations for Further Research

As the controversy continues on whether computers can and should be used in all areas of the curriculum, more research is needed to determine how faculty feel about computer technology and its role in the traditional pedagogy. Future studies will need to explore the same issues raised by this study but for K-12 as well as the University setting. Future studies should also be conducted using an experimental design.

Because this study used faculty self-reports of use, there was no way to differentiate between perceived use and actual use. Replication of this study should include direct observations and ratings of use between schools of varying levels to determine if actual use does vary from school to school.

Limitations

As in many causal comparative studies, the constructs were based on self-report measures, which may have artificially inflated relations among factors. Also, survey studies may be compromised by the comparability of results across different school settings.

Another limitation of this study is that it relied exclusively on faculty self-reports. The validity of this data is controvertible in view of potential social desirability. However, because respondents did not consistently respond favorably, and there were

strong correlations between respondent ratings of the independent and dependent variables, the validity of their perceptions is supported.

A second limitation is that contextual factors may have influenced the results (e.g., school size; smaller schools are limited by smaller budgets, and therefore may be less able to provide equivalent support). Socioeconomic status of student populations were not considered in this study, and may be a contributing variable. These are only a few of the potentially confounding variables that may have affected the outcomes of this study.

APPENDIX A

AVAILABLE STAFF AND TECHNOLOGY

1. Does your school provide open computer classrooms for all students?
   - ☐ yes ☐ no
   - if yes, approximately how many? ☐ 1-2 ☐ 3-4 ☐ 5 or more
   - if yes, beginning what year? _____
   - if yes, how many stations per classroom? ☐ 10+ ☐ 20+ ☐ 30+ ☐ 40+

2. Do any individual departments have (control) computer classrooms?
   - ☐ yes ☐ no
   - if yes, approximately how many? ☐ 1-2 ☐ 3-4 ☐ 5 or more
   - What was the first year your school provided them? _____

3. Does your school have a faculty development room for computer technology?
   - ☐ yes ☐ no
   - if yes, beginning what year? _____

4. Do you have a technical person on staff who is available to assist faculty with technology?
   - ☐ yes ☐ no
   - if yes, ☐ full time ☐ part time
   - if yes, beginning what year? _____

5. Does your school have someone on staff to provide instructional technology training for faculty?
   - ☐ yes ☐ no
   - if yes, ☐ full time ☐ part time
   - if yes, beginning what year? _____

6. Do you have classrooms with Internet connections?
   - ☐ yes ☐ no
   - if yes, how many?_____

7. Do you have "smart carts" available?
   - ☐ yes ☐ no
   - if yes, how many?_____

8. Do you have any other information which may be helpful in determining the level of support for technology provided by your campus?

_____
_____
_____
_____
_____
_____

APPENDIX B

ADMINISTRATIVE SUPPORT FOR COMPUTERS IN THE CLASSROOM

Administrative Support

Department_____

Directions: Please mark the answer which indicates the extent to which you believe your school administration has supported technology in each area.

Each statement begins with

"This school . . ."

	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE
1. provides sufficient equipment in classrooms for students				
2. provides sufficient equipment in open computer laboratories				
3. provides sufficient computer equipment to individual faculty				
4. upgrades software regularly, as needed				
5. provides equipment necessary for faculty to produce multimedia presentations				
6. provides call-in technical support all faculty				
7. sufficiently maintains classroom computers				
8. sufficiently maintains faculty computers				
9. sufficiently maintains computer laboratories				
10. provides sufficient technical support to meet faculty needs				
11. gives instructors release time, flex credit and/or compensation to develop computer coursework				
12. gives instructors release time and/or compensation to attend technology training				
13. compensates faculty for time spent in developing and incorporating technology into their curriculum				
14. provides on-campus training in computer applications				
15. provides training at times faculty are available				
16. provides training in the effective uses of technology				
17. provides follow-up consultation with an expert after training				

APPENDIX C

TASK SELF-CONCEPT and TASK VALUE

Directions: Please answer the following by putting a mark (X) in either "strongly disagree," "slightly disagree," "slightly agree," or "strongly agree" column.

	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE
1. I would feel OK about trying a new problem on the computer.				
2. I think I can do advanced computer work.				
3. I am not the type to do well with computers.				
4. I have self-confidence when it comes to using computers.				
5. I find learning new computer applications difficult.				
6. Working with a computer would make me very nervous.				
7. I feel threatened when others talk about computers.				
8. I would feel at ease in a computer class.				
9. Computers make me feel uncomfortable.				
10. I get confused when working on a computer.				
11. Technology will enable me to reach more students.				
12. With technology I can address different learning styles better.				
13. I believe computers are effective teaching tools.				
14. With technology I can provide individualized feedback.				
15. With technology I can address student interests better.				
16. I enjoy working with technology.				
17. I explored using computers for teaching on my own.				

APPENDIX D

COMPUTER COMPETENCY

COMPUTER COMPETENCY

Definitions of Terms

1. Not Familiar - you do not know that function existed, or if you do know, you have no idea how to execute it.

2. Somewhat Familiar - you are aware of the function, have executed it a few times or have seen someone execute it, and feel confident that you could 'figure it out' if you needed to use it; you may need the 'help' menu or someone to 'walk you through it'.

3. Somewhat Proficient - you have used the function(s), and can execute it without help, even if you make some errors occasionally; you are comfortable with the idea that if you did it incorrectly, you could 'figure it out' through trial and error.

4. Proficient - you can execute the function(s) flawlessly and quickly, and would feel comfortable helping someone else with the function.

Basic Word Processing

1. Can you perform simple edits (e.g., cut, copy, paste)?
☐ not familiar ☐ slightly familiar ☐ somewhat proficient ☐ proficient

2. Can you perform simple formatting tasks such as changing font styles (bold, italic, font type, color, etc.?
☐ not familiar ☐ slightly familiar ☐ somewhat proficient ☐ proficient

Spreadsheets

3. Can you use formulas and advanced editing functions?
☐ not familiar ☐ slightly familiar ☐ somewhat proficient ☐ proficient

Educational Software

4. Do you know how to create your own programs for instruction? (using such programs as Director, Authorware, or others)
☐ not familiar ☐ slightly familiar ☐ somewhat proficient ☐ proficient

Internet

5. Do you know how to use hyperlinks, search engines, gophers, and similar Internet tools?
☐ not familiar ☐ slightly familiar ☐ somewhat proficient ☐ proficient

Multimedia Presentations

6. Can you create basic slide presentations using programs such as Powerpoint?
☐ not familiar ☐ slightly familiar ☐ somewhat proficient ☐ proficient

7. Can you alter or manipulate pictures using programs such as Photoshop?
☐ not familiar ☐ slightly familiar ☐ somewhat proficient ☐ proficient

Peripherals

8. Can you use a scanner?
☐ not familiar ☐ slightly familiar ☐ somewhat proficient ☐ proficient

9. Can you upgrade computer software?
☐ not familiar ☐ slightly familiar ☐ somewhat proficient ☐ proficient

10. Can you upgrade computer hardware, or install a sound card or other internal device?
☐ not familiar ☐ slightly familiar ☐ somewhat proficient ☐ proficient

APPENDIX E

COMPUTER USE BY FACULTY

COMPUTER USE BY FACULTY

Directions: Please indicate the number of times you use computers for each of the following activities.
SOMETIMES: less than once per week;
OFTEN: at least once per week, but not daily;
DAILY: approximately once per day;
DAILY+: more than once per day.

TYPE OF USE - IN THE CLASSROOM	NEVER	SOME-TIMES	OFTEN	DAILY	DAILY+
1. give presentations/demos					
2. desktop publishing					
3. drill and practice					
4. testing/evaluation					
5. tutorials					
6. telecommunication					
7. web publishing					
8. web browsing/research					
9. other instructional purposes					

TYPE OF USE -OUTSIDE THE CLASSROOM	NEVER	SOME-TIMES	OFTEN	DAILY	DAILY+
1. create presentations/demos					
2. homework assignments					
3. creating tests/handouts					
4. web browsing/research					
5. web publishing					
6. creating multimedia					
7. e-mail					
8. grading					
9. other administrative tasks					
10. other instructional purposes					

please circle the year you started teaching: 1997 1996 1995 1994 1993 1992 1991 1990 1989 1988 1987 1986 1985 prior to 1985

please circle your highest degree: B.A./B.S. M.A./M.S. 2 or more M.A./M.S.s Ed.D. Ph.D.

Gender: Male Female

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